AIR QUALITY TECHNICAL SUPPORT DOCUMENT for the PROPOSED MONUMENT BUTTE OIL AND GAS DEVELOPMENT PROJECT

September 23, 2013

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Prepared by:

Russell E. Erbes, CCM
Senior Principal Air Quality Scientist

Reviewed by:

Michele Steyskal
Michele Steyskal
Air Quality Project Professional

KLEINFELDER
300 E. Mineral Avenue, Suite 7
Littleton, CO 80122
303.781.8211
FAX: 303.781.1167

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1 EXECUTIVE SUMMARY

This Air Quality Technical Support Document (AQTSD) describes the process used to conduct an air quality impact assessment (AQIA) for the proposed Newfield Exploration Company (Newfield) Monument Butte Oil and Gas Development project.

1.1 Introduction to the Project and AQIA

The proposed project will be implemented in the Monument Butte Project Area (MBPA) which is located within the Greater Monument Butte Unit in southeast Duchesne County and southwest Uintah County in the state of Utah. The MBPA is shown on Figure 1-1, which is located at the end of this Section.

There are four alternatives for the proposed project:

- Alternative A: Proposed Action
- Alternative B: No Action
- Alternative C: Field-Wide Electrification
- Alternative D: Resource Protection (Agency Preferred Alternative)

The Proposed Action (Alternative A) is to drill, develop, and operate up to 5,750 oil and gas wells in the MBPA, along with the required infrastructure. In summary, the Proposed Action includes:

- Drill, develop, and operate up to 3,250 Green River oil wells and 2,500 deep gas wells on existing and new well pads
- Construct additional roads and pipelines to serve the wells
- Construct 20 new gas compressor stations to serve the deep gas wells
- Expand 3 existing compressor stations and add one new compressor station to serve the oil wells
- Construct a new 50 million standard cubic feet per day (MMscf/d) centralized gas processing plant
- Construct 7 new and expand 6 water treatment and injection facilities
- Construct up to 12 new gas oil separation plants (GOSPs) for oil and produced water collection

- Develop one fresh water collector well for water flood operations and add 6 water pump stations

The Proposed Action includes a large number of Applicant Committed Environmental Protection Measures (ACEPMs) that reduce overall environmental impact and the potential air quality impacts. The ACEPMs are listed in Section 2.

Under the No Action Alternative, the proposed project would not be implemented but oil and gas development in the MBPA would continue to occur on private and state lands and on Bureau of Land Management (BLM) administered lands as previously authorized through other Environmental Impact Statement (EIS) Records of Decision (RODs). A total of 788 wells (579 oil wells and 209 gas wells) would be developed under the No Action Alternative. The ACEPMs and other measures that would be taken by Newfield under the Proposed Action would not occur under the No Action Alternative. However, promulgated regulatory requirements apply to both the Proposed Action and No Action Alternatives.

Under Alternative C, Newfield would implement field-wide electrification of various well field components (e.g., pumpjack engines). This Alternative would include the same oil and gas operations as Alternative A, but add 11 substations that consist of two 20 megawatt electric (MWe) gas turbine generators and one 10 MWe steam turbine generator at each substation (50 MWe per substation) for a total generation capacity in the MBPA of 550 MWe. Overhead transmission and distribution lines would also be added to distribute the electrical energy from the substations to the end use.

Alternative D is similar to Alternative A, but reduces the number of well pads and wells in order to protect sensitive areas within the MBPA. Alternative D would result in a total of 5,058 wells being drilled, developed, and operated (3,519 oil and 1,539 deep gas).

The Proposed Action and Alternatives are further described in Section 2 of this AQTSD.

In order to conduct the AQIA, first the existing background air quality was determined along with the evaluation criteria that will be used to evaluate the potential ambient air quality impact of the Proposed Action and Alternatives. Then emission estimates of criteria and key hazardous air pollutants were developed for each of the Alternatives. For Alternative A, not only were emission estimates developed for the maximum impact year when all of the proposed wells were developed and operating, annual development emission estimates were made for a ten-year period, 2012 through 2022.

Once the emissions were determined, dispersion models were used to evaluate the potential impact in the near field (less than 50 kilometers (km) from the sources) and far field (i.e., potential impacts at distant Class I areas, Class II areas, and sensitive lakes).

The evaluation criteria were the National Ambient Air Quality Standards (NAAQS) for criteria pollutants, toxic screening levels and other reference concentrations for hazardous air pollutants, and air quality related value (AQRV) thresholds specified by the Federal Land Managers for the Class I areas, sensitive Class II areas, and sensitive lakes. The evaluation criteria are discussed in detail in Section 3. Section 3 also presents the pre-project, background ambient air quality conditions in the MBPA.

1.2 Proposed Project and Alternatives Emissions

Table 1-1 summarizes the emissions for the four alternatives. Details are provided in Section 4 and the appendices.

Table 1-1
Proposed Action and Alternatives Emissions

Pollutant	Alternative A: Proposed Action (tpy)	Alternative A: Proposed Action Only through 2022[a] (tpy)	Alternative B: No Action (tpy)	Alternative C: Field-Wide Electrification (tpy)	Alternative D: Resource Protection (tpy)
Criteria Pollutants					
NO_x	5,690.1	744.7	1,817.3	1,994.8	4,900.9
CO	8,523.8	----	1,497.4	1,949.3	7,062.1
VOC	10,360.9	4833.0	2,116.9	8,366.2	9,480.2
SO_2	14.4	----	2.8	9.4	12.5
PM_{10}	2,903.6	----	810.1	2,709.0	2,687.3
$PM_{2.5}$	617.0	----	157.0	422.3	573.0
Hazardous Air Pollutants					
Benzene	62.57	----	13.75	53.27	51.39
Toluene	75.90	----	28.04	72.44	56.81
Xylene	44.67	----	43.26	43.78	30.51
Formal-dehyde	380.99	----	49.80	9.79	338.73
Acrolein	45.60	----	6.33	0.087	41.97
Total HAPs	1,004.73	----	227.61	480.17	920.71
Greenhouse Gases					
CO_2	2,830,690	----	461,805	3,134,441	2,448,615
CH_4	12,587	----	1,686	12,582	9,943
N_2O	6.13	----	1.45	6.71	5.25
GWP	3,096,936	----	497,665	3,400,752	2,659,049

[a] Only NOx and VOC emissions were calculated for the annual emission analysis.

1.3 Substantial Increase in Emissions Assessment

As indicated, under the No Action Alternative, oil and gas development will continue in the MBPA under previously authorized RODs on federal mineral estates and on state and private lands. For purposes of assessing potential ozone impacts, the Proposed Action emissions were compared to the No Action Alternative emissions to determine if there would be a substantial increase in ozone precursor (NOx and VOC) emissions. For purposes of this document, "substantial increase" is defined as emissions from the Proposed Action that are greater than emissions from the No Action Alternative. As shown in Table 1-1, annual development of the Proposed Action can occur until approximately early calendar year 2021 without total NO_x and VOC emissions exceeding emissions that would occur under the No Action Alternative. As shown in Section 4 and discussed in Section 6, by calendar year 2021 there could be a net increase of over 1,000 oil and gas wells in the MBPA and not cause NO_x plus VOC emissions to exceed the No Action Alternative emissions. There would be no substantial increase in NOx emissions alone through 2022. There could be a substantial increase of VOC emissions by late 2019 (i.e., VOC emission increases from annual development of the Proposed Action could exceed emission increases under the No Action Alternative). This level of development can occur because Newfield will implement a number of emission reducing measures and ACEPMs in order to reduce emissions from existing and future oil and gas wells, and because the existing level of infrastructure can service the additional wells.

1.4 Near Field Dispersion Modeling and Results

For near field impacts, five different source configurations were developed in order to assess the maximum potential impact of construction and development emissions as well as operation (production) emissions. The modeling scenarios are as follows and are discussed in detail in Section 5:

- Alternative A – Proposed Action: Well construction and development
- Alternative A – Proposed Action: 20-acre downhole spacing oil well operations
- Alternative A – Proposed Action: 40-acre surface spacing gas well operations
- Alternative C – Field Wide Electrification: 20-acre downhole spacing oil well operations
- Alternative C – Field Wide Electrification: 40-acre surface spacing gas well operations

Construction and development activities are essentially the same under all of the Alternatives and thus only one modeling scenario is needed to assess the impact of construction and development emissions.

The United States Environmental Protection Agency (USEPA) recommended AERMOD dispersion model was used with five years of meteorological data (2005 – 2009) collected at Vernal Utah, and obtained from the Utah Department of Environmental Quality – Division of Air Quality (UDAQ). The impact modeling methodology is further described in Section 5 and the results are presented in Section 7.

The maximum near field impacts for the criteria pollutants are shown in Table 1-2. The maximum impacts for all except PM_{10} and $PM_{2.5}$ were from well or infrastructure operations. The maximum short term PM_{10} and $PM_{2.5}$ impacts were from construction and development of the well field. The maximum CO 1-hour impacts are from the 40-acre surface spacing gas well operations from Alternative A modeling scenario, while the CO 8-hour, NO_2 and SO_2 impacts are from the 20-acre downhole spacing oil well operations from Alternative A.

Table 1-2
Maximum Potential Project Impacts

Pollutant	Averaging Period	Ambient Air Concentration (µg/m³)			
		Maximum Modeled Impact	Background	Total	NAAQS
CO	1-hour	265	2,641	2,906	40,000
	8-hour	137	1,657	1,794	10,000
NO_2	1-hour	106.9 [a]	57.7	164.6	188
	Annual	16.5	7.3	23.8	100
SO_2	1-hour	0.7	20.1	20.8	196
	3-hour	0.6	14.3	14.9	1,300
PM_{10}	24-hour	72.5	18.7	91.2	150
$PM_{2.5}$	24-hour	14.3	17.8	32.1	35
	Annual	1.4	8.0	9.4	12

[a] Assumes NO to NO_2 conversion of 80%

The maximum air toxics near field impacts for non-carcinogenic impacts are shown in Table 1-3 and potential carcinogenic impacts are shown in Table 1-4. The maximum impacts for 1-hour acrolein, annual acrolein, annual formaldehyde, and annual benzene are from well operations in the 20-acre downhole spacing oil well operations scenario from Alternative A. The maximum impacts for 1-hour formaldehyde and 1-hour benzene are from the 40-acre surface spacing gas well operations from Alternative A modeling scenario. The impacts of acrolein, benzene, and formaldehyde are the greatest with respect to the RELs and RfCs, and thus are the only three reported in Table 1-3. However, emissions from all hazardous air pollutants are quantified.

Table 1-3
Maximum Potential Non-Carcinogenic REL and RfC Impacts

HAP	Modeled Maximum 1-Hour Impact ($\mu g/m^3$)	REL ($\mu g/m^3$)	1-Hour Toxic Screening Levels [a] ($\mu g/m^3$)	Modeled Maximum Annual Impact ($\mu g/m^3$)	RfC ($\mu g/m^3$)	Annual Toxic Screening Levels [b] ($\mu g/m^3$)
Acrolein	1.50	2.5	23	0.18	0.35	--
Benzene	5.55	1,300	18	0.30	30	--
Formaldehyde	12.32	55	37	1.27	9.8	--

[a] The TSL for benzene is a 24-hour average, but the 1-hour concentration is conservatively compared to the TSL.
[b] The TSLs do not exist for annual averages.

Table 1-4
Maximum Potential Carcinogenic Risk

Exposure Scenario	HAP	Modeled Annual Impact ($\mu g/m^3$)	Cancer Risk
MLE	Benzene	0.30	6.2×10^{-08} to 2.2×10^{-07}
	Formaldehyde	1.27	1.6×10^{-06}
	TOTAL MLE RISK		**1.8×10^{-6}**
MEI	Benzene	0.30	3.8×10^{-07} to 1.3×10^{-06}
	Formaldehyde	1.27	9.4×10^{-06}
	TOTAL MEI RISK		**1.1×10^{-05}**

1.5 Far Field Dispersion Modeling Results

Section 5 describes the details of the far field impact assessment methodology. The CALPUFF system of dispersion models was used for the far field assessment. One modeling scenario, Alternative A – Proposed Action, was modeled as this scenario has the maximum non-particulate emissions. The Class I and sensitive Class II areas evaluated include the following:

National Park Service (NPS) Class I Areas

- Arches National Park
- Black Canyon of the Gunnison National Park
- Canyonlands National Park
- Capitol Reef National Park
- Great Sand Dunes National Park and Preserve
- Mesa Verde National Park

USFS Class I Areas

- Eagles Nest Wilderness Area
- Flat Tops Wilderness Area
- La Garita Wilderness Area
- Maroon Bells-Snowmass Wilderness Area
- Mount Zirkel Wilderness Area
- Weminuche Wilderness Area
- West Elk Wilderness Area

NPS Class II Areas

- Colorado National Monument
- Dinosaur National Monument
- USFS Class II Areas
- Flaming Gorge National Recreation Area
- High Uintas Wilderness Area
- Holy Cross Wilderness Area
- Hunter/Frying Pan Wilderness Area
- Raggeds Wilderness Area

U.S. Fish and Wildlife Service Class II Areas

- Browns Park National Wildlife Refuge

Potential impacts in the noted Class I and sensitive Class II areas for criteria pollutants, regional haze, and acid deposition were assessed. In addition, potential change in acid neutralizing capacity (ANC) for sensitive lakes within these areas was also evaluated. Criteria pollutant impacts were compared to Prevention of Significant Deterioration (PSD) increments only as a point of information. The PSD program is a regulatory program implemented by the state of Utah, and the Proposed Action is not subject to the PSD program.

As discussed in Section 8, none of the far field impacts exceeded the PSD Class I and II increment evaluation criteria. Acid deposition at the sensitive lakes exceeded the Deposition Analysis Thresholds (which represent deposition in the absence of any anthropogenic activity and are used by Federal Land Managers to make project-specific decisions regarding adverse impacts); but none of the impacts exceeded the deposition impact thresholds. Regional haze impact evaluation thresholds were exceeded in the closest sensitive Class II areas. The largest impact was at Dinosaur National Monument where there were 131 days where the change in light extinction exceeded 0.5 deciviews (dV) The 98th percentile change in light extinction was 3.2 in Dinosaur National Monument. There was also one day in the Class I area of Arches National Park where the maximum change in light extinction exceeded 1.0 dV, but the 8th-high (98th percentile) was less than 1.0 dV.

1.6 Cumulative Impacts and Project Specific Ozone Modeling

The BLM is developing a Uinta Basin specific photochemical modeling platform as part of its air resource management strategy (ARMS) for the Uinta Basin. The ARMS modeling platform will replace CALPUFF modeling for far field project specific and cumulative impact analyses. The ARMS platform will also become the standard photochemical modeling system for assessing project specific and cumulative impacts on both near and far field ozone concentrations. Accordingly, this AQIA did not explicitly model the far field cumulative potential impacts of the Proposed Action and Alternatives or the project-specific impact on local and distant ozone concentrations. Rather, the cumulative and ozone impact assessment conducted as part of the Greater Natural Buttes (GNB) Final Environmental Impact Statement (BLM 2012) was incorporated into the Newfield Monument Butte Oil and Gas Development Project EIS by reference. The GNB cumulative and ozone impact assessment evaluated the impacts of not only the proposed GNB project, but also the impacts of reasonable future development (RFD) in the Uinta Basin, and the RFD analyzed in the GNB FEIS explicitly included the Newfield Monument Butte Proposed Action. Accordingly, until the ARMS modeling platform becomes available, reviewing and incorporating the GNB analysis is the most appropriate method to evaluate potential ozone impacts and cumulative impacts of the Proposed Action and Alternatives. The results from GNB are not included in this AQTSD, but are summarized in the text of the Newfield Monument Butte EIS.

1.7 Adaptive Management Strategy for Potential Ozone Impacts

The No Action and Proposed Action emissions inventories demonstrated that although emissions from the Proposed Action will eventually exceed emissions that would occur under the No Action Alternative; for the first several years of the project, emissions associated with the No Action Alternative would be greater than any of the Action Alternatives (A, C, or D). Despite the fact that GNB assessed potential ozone formation for emissions including the Newfield Proposed Project and that No Action emissions would be greater than the Action Alternatives for the first few years of the Project; the fact that the Action Alternative emissions will eventually exceed the No Action emissions requires implementation of an Adaptive Management Strategy to mitigate the potential for adverse ozone formation. Details of the Adaptive Management Strategy are discussed in Section 6 of this AQTSD, but the Strategy includes the following major elements that will be implemented under all three of the Action Alternatives:

- Newfield will conduct an annual emissions inventory and compare the inventory to the emissions estimates contained in this Environmental Impact Statement.

- Regional photochemical modeling will be conducted that includes emissions for the selected alternative within one year of the ROD for this project or one year of the BLM Air Resources Management Strategy (ARMS) modeling platform becoming available; whichever occurs first. If modeled impacts show that the National Ambient Air Quality Standards (NAAQS) or applicable thresholds for air quality related values may be exceeded, BLM will require additional mitigation measures within BLM's authority to prevent exceedances.

1.8 Summary

In summary, all of the evaluated potential air quality impacts of the Proposed Action and Alternatives are less than the evaluation criteria except for regional haze impacts in two sensitive Class II areas and one day in Arches National Park. The Federal Land Managers have not published thresholds for Class II areas.

No project specific ozone impact modeling was conducted due to the unavailability of a modeling assessment platform. When the Proposed Action Annual Development is compared to emissions that would occur under the No Action Alternative, it is found that annual development of the Proposed Action can continue through approximately early calendar year 2021 without causing a substantial increase in total ozone precursor emissions, or late 2019 for VOC emissions alone. This is due to the extensive ACEPMs and other emission reducing measures that Newfield will implement as future development in the MBPA proceeds under the Proposed Action or Alternatives C and D. Nevertheless, an Adaptive Management Strategy to mitigate potential ozone formation will be implemented under any of the Action Alternatives.

Section 2 describes the Proposed Action and Alternatives, Section 3 the pre-project background air quality, Section 4 the emissions, and Section 5 the impact assessment methodology. Sections 6, 7 and 8 describe the evaluation results. The Appendices contain hard copies of the emission inventories and electronic copies of the modeling input and output files.

FIGURE 1-1: Newfield Monument Butte Project Area Location

2 DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

2.1 Alternative A – Proposed Action

The Proposed Action involves drilling and operations of up to 3,250 oil wells and 2,500 gas wells in the MBPA, including associated infrastructure. The Proposed Action includes the following primary components:

- Development of up to 750 Green River oil wells on 40-acre surface and downhole spacing drilled from new 2-acre well pads, all of which would be converted into water-flood injection wells within approximately 3 years;
- Development of up to 2,500 Green River oil wells on 20-acre downhole spacing that would be vertically, directionally, or horizontally drilled from existing and/or proposed 40-acre surface spaced Green River oil well pads, consistent with current State spacing requirements;
- Development of up to 2,500 vertical deep gas wells on 40-acre surface and downhole spacing drilled from new 3-acre well pads, which would be constructed adjacent to Green River oil well pads in order to reduce new surface disturbance and utilize existing utility infrastructure and access roads;
- Construction of approximately 243 miles of new 100-foot wide ROW that would be used for new road construction (40-foot width) and pipeline installation (60-foot width). Up to 70-foot wide expansion along approximately 363 miles of existing access road ROW that would be used for road upgrade (10-foot width) and pipeline installation (60-foot width);
- Construction of 20 new compressor stations for deep gas well development;
- Expansion of three (3) existing Green River oil well compressor stations and construction of one (1) new compressor station for gas associated with Green River oil well development;
- Construction of a 50 million standard cubic feet per day (MMscf/d) centralized gas processing plant;
- Construction of seven (7) new and expansion of six (6) existing water treatment and injection facilities for management and distribution and injection of produced water;
- Construction of up to 12 Gas Oil Separation Plants (GOSPs) for oil and produced water collection;
- Development of one (1) fresh water collector well for water-flood operations; and
- Construction of six (6) water pump stations.

Newfield currently operates approximately 3,395 oil and gas wells in the MBPA, and proposes to drill additional wells at an average rate of approximately 360 wells per year until the resource base is fully developed. Under this drilling scenario, construction, drilling, and completion of up to 5,750 wells would occur in approximately 16 years. The total number of wells drilled would depend largely on outside factors such as production success, engineering technology, reservoir characteristics, economic factors, commodity prices, rig availability, and lease stipulations. The anticipated life of an individual well is 20 to 30 years, and the anticipated time it would take for field abandonment and final reclamation is 5 years. Therefore, the anticipated life of project (LOP) under the Proposed Action would be from 41 to 51 years.

The Proposed Action and Alternatives include applicant committed environmental protection measures (ACEPMs). The ACEPMs relevant to reducing potential air quality impacts are summarized as follows:

General

- Newfield would use water or other BLM-approved dust suppressants as needed during drilling, completion, and high traffic production operations for dust abatement.
- Newfield employees would comply with posted speed limits on unpaved county roads used for access and would use safe vehicle speeds on other unpaved access roads. Newfield would instruct contractors to comply with posted speed limits.
- The use of carpooling would be encouraged to minimize vehicle traffic and related emissions and Newfield will implement a vehicle policy to minimize idling while also recognizing safety concerns.
- Newfield would conduct a pilot test to evaluate the feasibility for converting fleet vehicles to cleaner burning compressed natural gas (CNG) or liquefied natural gas (LNG) fuels. The results of the pilot test would be submitted to the AO.

Drilling / Completion Operations

- Newfield would use Tier II diesel drill rig engines or equivalent with the phase-in of Tier IV engines or equivalent emission reduction technology by 2018.
- Newfield would employ reduced emission completion practices, including storing or re-injecting recovered liquids and routing recovered gas into a well or using the recovered gas as fuel for another useful purpose when feasible; routing all saleable quality gas to a flow line as soon as practicable; and safely maximizing resource recovery and minimizing potential VOC emissions from hydraulically fractured, high pressure gas well

flowback operations. If flowback emissions cannot be routed to a flow line, they will be captured and routed to a completion combustion device unless such device will result in a fire or explosion hazard.

Production Operations

- Newfield would utilize low or intermittent bleed pneumatic devices to minimize VOC emissions. High bleed devices may be allowed for critical safety and/or process purposes. Intermittent pneumatic devices will be operated such that average emissions are no greater than for a low bleed device.
- High bleed pneumatic devices at existing Newfield facilities would be replaced/retrofitted with low or intermittent bleed devices when repair or replacement is warranted, and no later than six (6) months after the ROD is signed. High bleed devices may be allowed to remain in service for critical safety and/or process purposes.
- Newfield would employ glycol dehydrator still vent emission controls with a control efficiency of 95 percent or greater.
- Newfield would conduct a study to evaluate the feasibility for the implementation of “low emission” glycol dehydrators. The results of this study would be submitted to the AO.
- Newfield would install emission controls with an efficiency of 95 percent on the following:
  - New oil and condensate storage tanks
  - Tanks that have been modified or re-constructed after August 23, 2011, with the potential to emit greater than 6 tons per year (tpy) VOC
  - All other tanks with the potential to emit greater than 20 tpy within 24 months of signing the ROD.
- Newfield would implement a telemetry monitoring system where feasible to provide for the effective management of production exceptions while reducing the number of vehicle trips and miles traveled.

Central Facilities

- Newfield would install electric motor driven compression where feasible. Where electrification is not feasible, Newfield would utilize lean-burn natural gas fired compressor engines or equivalent rich-burn engines with catalysts. Lean-burn engines would be fitted with oxidation catalysts to minimize carbon monoxide and VOC emissions.
- Newfield would maximize the use of central compression thereby reducing the need for smaller and less efficient (higher emission) well site compressor units.

- Newfield would periodically replace rod packing systems on reciprocating compressors and use only dry seals on centrifugal compressors to minimize the loss of VOC.
- Newfield would employ glycol dehydrator still vent emission controls with a control efficiency of 95 percent or greater.
- Newfield would install emission controls with an efficiency of 95 percent or greater on stock tanks that have the potential to emit VOC greater than 6 tons per year (tpy).

GOSP Implementation

- Where feasible, Newfield would implement Green River oil gathering systems and construct GOSPs. With GOSP implementation, the majority of the stock tanks, produced water tanks and related tank heaters at affected existing well sites would be removed from service. New wells served by a GOSP would be constructed without tank batteries thereby eliminating tank battery and related tanker truck emissions.
- The GOSP facilities would be specifically designed to minimize the emission of VOC. Storage tank emissions would be captured and reused within the facility process or sold as product. Vapors from truck loading operations would be controlled by 95 percent.

Monitoring Programs

- Newfield would annually evaluate the deep gas gathering system to identify opportunities for pressure optimization resulting in reduced flash emissions from condensate storage tanks.
- Newfield would implement visual inspections of thief hatch seals and pressure relief valves on condensate tanks to ensure proper operation and minimize losses of VOCs. Inspections will be conducted at least annually during a routine maintenance visit. If for some reason monitoring does not occur within 12 months, the visual inspection will be conducted at the next scheduled maintenance visit.

Adaptive Management

- Newfield would implement an adaptive management program that would evaluate project specific emissions on an annual basis and identify opportunities to further reduce emissions.

Cooperative Efforts and Outreach

- Newfield would encourage and lend technical support to scientific research efforts focused on improving the understanding of ozone formation chemistry within the Uinta Basin, emission inventory enhancements, source apportionment studies, ozone precursor transport studies, precursor sensitivity studies, and evaluations of cost effective control strategies.

- Newfield would incorporate ozone awareness and specific actions for reducing ozone precursor emissions into the current employee training program.

In addition to the ACEPMs, Newfield will implement an Adaptive Management Strategy to mitigate potential adverse ozone formation as described in Section 6 of this AQTSD.

2.2 Alternative B – No Action

Under the No Action Alternative, the proposed oil and gas infill development project on public land surface and/or federal mineral estates as described in the Proposed Action would not be implemented. However, proposed oil well development would likely continue on State and private lands within the Monument Butte Field, subject to the approval of UDOGM or the appropriate private land owner. Reasonable access across BLM-administered surface to proposed well pads and facilities on State and private lands could also occur under the No Action Alternative, as allowed by Federal regulations. Development, production, and maintenance activities for wells approved under the August 2005 Record of Decision (ROD) for the Castle Peak and Eight Mile Flat Oil and Gas Expansion EIS and approved Master Development Plans (MDPs) would also continue on BLM-administered lands. The No Action Alternative would result in an additional 788 oil and gas wells being drilled and placed into production in the MBPA. Further details related to emissions associated with the No Action Alternative are discussed in Section 4.

2.3 Alternative C – Field-Wide Electrification

This alternative was developed in response to air quality issues raised during the public and agency scoping process. The principal component of this alternative entails a phased field-wide electrification system that would be integrated in the MBPA over an estimated 7 year period. This alternative would incorporate the same construction and operation components for the Proposed Action, except that gas-driven motors would be converted to electric motors as field electrification is phased into the Project Area. The electrical energy would be supplied either from substations built by Newfield or from commercial power.

Under Alternative C, the same number (5,750) of oil and gas wells as the Proposed Action would be developed in the MBPA. Alternative C includes all of the Proposed Action components plus the following if the electrical power is provided by Newfield substations:

- Phased field-wide electrification consisting of construction of approximately 34 miles of overhead, cross-country 69kV transmission line, 156 miles of distribution lines, and construction of 11 substations;
- Installation of two 20 megawatt electric (MWe) gas turbine generators and one 10 MWe steam turbine for a combined generation of 50 MWe at each of the 11 substations (550 MWe throughout the MBPA);
- Replacement of all 3,250 pumpjack engines with electric motors;
- Replacement of all compressor engines with electric motors; and
- Removal of on-site gas-fueled electrical generators.

If commercial power provides the electrical energy, the gas turbine generators and steam turbine generators would not be built. The electrical substations would likely still be needed, however.

Under Alternative C, both the ACEPMS and the Adaptive Management Strategy of the Proposed Action (Alternative A) will also be implemented.

2.4 Alternative D – Resource Protection (Agency Preferred Alternative)

Alternative D, the Resource Protection Alternative, is the Agency Preferred Alternative. Alternative D was developed to respond to sensitive resource and land use issues in the Project Area expressed during public and agency scoping. For the MBPA, the primary objective of the Resource Protection Alternative is to meet the purpose and need for the Project while avoiding new surface disturbance within the Pariette ACEC, minimizing the amount of new surface disturbance within USFWS proposed Level 1 and 2 Core Conservation areas (for two federally-listed plant species: the Uinta Basin hookless cactus [Sclerocactus wetlandicus] and Pariette cactus [Sclerocactus brevispinus], and minimizing the amount of new surface disturbance in other portions of the MBPA through the use of directional drilling technology.

Under Alternative D, the most restrictive conditions for oil and gas development would occur within the Pariette ACEC, where no new surface disturbance would be allowed. In order to access the hydrocarbon reserves beneath the Pariette ACEC, directional wells would be drilled from both new multi-well pads and existing well pads located adjacent to, but outside of, the ACEC. Recent advancements in horizontal drilling technology have increased the maximum horizontal displacement to distances of up to 2,500 feet without insurmountable technical and economic challenges. While a substantial portion of the hydrocarbon reserves could be recovered under the Pariette ACEC as a result of directional drilling, it is estimated that approximately 6,605 acres of hydrocarbon reserves beneath the Pariette ACEC (62 percent of the total area of the Pariette ACEC) would be unrecoverable.

This alternative would incorporate the same construction and operation components as the Proposed Action and Alternative C, but with fewer well pad locations and a substantially greater number of multiple directional wells drilled from single well pads. Under Alternative D, approximately 5,058 oil and gas wells would be developed on BLM, State, and private lands in the MBPA. Newfield proposes to drill the wells at an average rate of approximately 360 wells per year until the resource base is fully completed, requiring about 16 years for full development. (For purposes of this AQIA, the drilling rate was assumed to be 360 wells per year for 14 years; 3,519 of the wells would be oil and 1,539 of the wells would be deep gas.)

Alternative D includes the following primary components:

- Development of up to a total of 3,519 Green River oil wells with various surface spacing and placed on new and existing well pads.
- Development of up to 1,539 vertical deep gas wells
- Construction of up to 17 new compressor stations for deep gas well development;
- Construction of up to one (1) 50 MMscf/d centralized Green River oil well gas processing plant;
- Construction of up to five (5) new and expansion of five (5) existing gas driven water treatment and injection facilities for management and distribution and injection of produced water;
- Construction of up to eight (8) GOSPs for oil and produced water collection;
- Development of one (1) fresh water collector well for water-flood operations; and
- Construction of four (4) water pump stations.

Under Alternative D, both the ACEPMS and the Adaptive Management Strategy of the Proposed Action (Alternative A) will also be implemented.

3 PRE-PROJECT AMBIENT AIR QUALITY AND STANDARDS

Potential impacts of the proposed project are compared to the National and State Ambient Air Quality Standards, Prevention of Significant Deterioration (PSD) increments, and thresholds of concern as described in the following paragraphs.

3.1 Ambient Air Quality Standards and PSD Increments

Utah and National Ambient Air Quality Standards (UAAQS and NAAQS) have been promulgated for the purpose of protecting human health and welfare with an adequate margin of safety. Pollutants for which standards have been determined include sulfur dioxide (SO_2), nitrogen dioxide (NO_2), carbon monoxide (CO), ozone (O_3), particulate matter less than 10 microns in diameter (PM_{10}), and particulate matter less than 2.5 microns in diameter ($PM_{2.5}$) and lead (Pb). In Utah, the State and National Ambient Air Quality standards are the same and are shown in Table 3-1.

The PSD program establishes allowable incremental increases in ambient concentrations of certain pollutants. All of the land areas of the US are currently classified as either Class I or Class II. Class I areas include many national parks and wilderness areas and some Native American lands. Areas not designated Class I are designated Class II. Class I areas and sensitive Class II areas of interest for the Proposed Project are discussed in Section 5. The PSD increments are shown in Table 3-1.

Throughout this impact analysis, all comparisons with PSD increments are intended as a point of reference only and do not represent a regulatory PSD increment consumption analysis. PSD increment consumption analyses are applied to large industrial sources during the permitting process, and are the responsibility of the State of Utah with USEPA oversight. The Proposed Project is not subject to the PSD program.

Table 3-1
National and State Ambient Air Quality Standards and PSD Increments

Pollutant	Averaging Period(s)	NAAQS [a]	PSD Class I Increment [a]	PSD Class II Increment [a]
CO	1-hour 8-hour	35 ppm (40,000 µg/m^3) [b] 9 ppm (10,000 µg/m^3) [b]	-- --	-- --
NO_2	1-hour Annual	100 ppb (188 µg/m^3) [c] 0.053 ppm (100 µg/m^3) [d]	-- 2.5 µg/m^3	-- 25 µg/m^3
PM_{10}	24-hour Annual	150 µg/m^3 [e] -----	8 µg/m^3 4 µg/m^3	30 µg/m^3 17 µg/m^3
$PM_{2.5}$	24-hour Annual	35 µg/m^3 [c] 12 µg/m^3 [f]	2 µg/m^3 1 µg/m^3	9 µg/m^3 4 µg/m^3
O_3	8-hour	0.075 ppm [g]	--	--
SO_2	1-hour 3-hour 24-hour Annual	75 ppb (196 µg/m^3) [h] 0.5 ppm (1,300 µg/m^3) [b] ----- -----	-- 25 µg/m^3 5 µg/m^3 2 µg/m^3	-- 512 µg/m^3 91 µg/m^3 20 µg/m^3
Lead	Rolling 3 month	0.15 µg/m^3 [i]	--	--

[a] Source: 40 CFR Part 50 and 51
[b] Not to be exceeded more than once per year.
[c] 98th percentile averaged over 3 years.
[d] Annual mean.
[e] Not to be exceeded more than once per year on average over 3 years.
[f] Annual mean, averaged over three years.
[g] Annual fourth-highest daily maximum 8-hour concentration averaged over 3 years.
[h] 99^{th} percentile of 1-hour daily maximum concentrations, averaged over 3 years.
[i] Not to be exceeded.

3.2 Pre-Project Background Ambient Air Quality

Table 3-2 presents the background, pre-project, ambient air quality in the MBPA for the criteria pollutants and averaging times for which a NAAQS has been established. Available data from the most recent 6 years are presented. The data in Table 3-2 comes from the Greater Natural Buttes FEIS (BLM 2012) and the USEPA Air Quality Statistics web site (USEPA, 2013a). The data from Table 3-2 were used to select a single value for each NAAQS pollutant and averaging time to be used in the air quality impact assessment as the background pre-project values. The selected values and the rationale for the selection are presented in Table 3-3.

Table 3-2
Pre-Project Background Ambient Air Quality in the Uinta Basin

Criteria Pollutant	Average	Rank [a]	Year [b]	Value [c] (µg/m³)	Criteria Pollutant	Average	Rank [a]	Year [b]	Value [c] (µg/m³)	Station [d]
CO	1-hour	H2H	2007	4,350	CO	8-hour	H2H	2007	2,796	Grand Junction, CO
			2008	10,564				2008	2,641	
			2009	3,573				2009	2,175	
			2010	2,641				2010	1,709	
			2011	2,796				2011	1,709	
			2012	2,486				2012	1,554	
NO_2	1-hour	H8H	2009/ 2010	69.6 [e]	NO_2	Annual	H	2009/ 2010	9.0 [e]	Ouray, UT
			2010/ 2011	52.7 [e]				2010/ 2011	6.8 [e]	
			2011/ 2012	50.8				2011/ 2012	6.2	
NO_2	1-hour	H8H	2009/ 2010	58.3 [e]	NO_2	Annual	H	2009/ 2010	7.8 [e]	Redwash, UT
			2010/ 2011	60.2 [e]				2010/ 2011	8.1 [e]	
			2011/ 2012	54.5				2011/ 2012	7.9	
PM_{10}	24-hour	H2H	2004	19.0						Myton, UT [f]
			2005	20.0						
			2006	17.0						
			2012 [f]	48.0						
$PM_{2.5}$	24-hour	H8H	2009/ 2010	19.5 [e]	$PM_{2.5}$	Annual	H	2009/ 2010	7.3 [e]	Ouray
			2010/ 2011	23.6 [e]				2010/ 2011	12.3 [e]	
			2011/ 2012	18.5				2011/ 2012	6.9	
$PM_{2.5}$	24-hour	H8H	2009/ 2010	16.3 [e]	$PM_{2.5}$	Annual	H	2009/ 2010	6.3 [e]	Redwash
			2010/ 2011	17.8 [e]				2010/ 2011	9.4 [e]	
			2011/ 2012	11.3				2011/ 2012	5.5	

Table 3-2 (cont.)
Pre-Project Background Ambient Air Quality in the Uinta Basin

Criteria Pollutant	Average	Rank [a]	Year [b]	Value [c] (μg/m^3)	Criteria Pollutant	Average	Rank [a]	Year [b]	Value [c] (μg/m^3)	Station [d]
O_3	8-hour	H4H	2009/ 2010	117 ppb [e]						Ouray
			2010/ 2011	116 ppb [e]						
			2011/ 2012	68 ppb						
			2012/ 2013	>75 ppb [g]						
	8-hour	H4H	2009/ 2010	98 ppb [d]						Redwash
			2010/ 2011	100 ppb [d]						
			2011/ 2012	65 ppb						
			2012/ 2013	>75 ppb [g]						
SO_2	1-hour	H4H	2007	21.7 [e]	SO_2	3-hour	H2H	2007	16.0 [e]	Sweet-water, WY [h]
			2008	19.7 [e]				2008	16.7 [e]	
			2009	19.0 [e]				2009	10.1 [e]	
			2012 [h]	2.6				2012 [g]	0.9	

[a] Rank: H2H = High, 2nd high for NAAQS not to be exceeded more than once per year. H8H = 98th percentile. H4H = 99th percentile. H = maximum value for period.
[b] Calendar year, except when two years for the same value (e.g., 2007/2008) the period is July 1 through June 30. The July 1/June 30 periods were chosen due to lack of full calendar year data.
[c] Data are from the USEPA Air Quality Statistics web site (USEPA 2013a) except as noted. Conversion of CO and NO_2 from monitored ppm to ug/m^3 made at 1 atmosphere and 25 degrees C.
[d] Monitor location is the monitor closest to the Proposed Project area for which data are available in the USEPA AQS database. Grand Junction is Station ID 08-077-0018, Ouray is Station ID 49-047-2003, Redwash is Station ID 49047-2002, Myton is Station ID 49-013-7011, Sweetwater is Station ID 56-037-0200.
[e] Data reported in the Greater Natural Buttes Final Environmental Impact Statement (GNB FEIS) (BLM 2012).
[f] The Myton PM_{10} monitor collected data only through 2006. There is a new monitor in Roosevelt, UT located approximately 35 miles west-northwest of the Proposed Project area, Station ID 49-013-0002, which has PM_{10} data available from January 1, 2012 through August 30, 2012, and only those data are reported for 2012.
[g] Data from the winter of 2012/2013 are not yet available. However, raw data that have not yet been quality assured or summarized indicated that the NAAQS for ozone was exceeded at both the Ouray and Redwash monitors during the winter.
[h] The 2007 through 2009 data are from the Wamsutter Monitoring Station in Sweetwater County (Station ID 56-037-0200 as reported in the GNB FEIS (BLM 2012). There is a new monitor in Roosevelt, UT located approximately 35 miles west-northwest of the Proposed Project area, Station ID 49-013-0002, which has SO_2 data available from May 1, through June 30, 2012, and only those data are reported for 2012.

Table 3-3
Pre-Project Background Ambient Air Quality Values Used in AQIA

Criteria Pollutant	Average	Value ($\mu g/m^3$)	Rationale for Selection
CO	1-hour	2,641	Average of the most recent three years (2010 – 2012) of second-high values from the Grand Junction, CO monitor.
	8-hour	1,657	
NO_2	1-hour	57.7	Average of the most recent three years available (July 1, 2009 – June 30, 2012) of eighth-high values (98th percentile) for both the Ouray and Redwash monitors.
	Annual	7.3	Average of the most recent three years available (July 1, 2009 - June 30, 2012) for both the Ouray and Redwash monitors.
O_3	8-hour	184 (94 ppb)	Average of the most recent three years available (July 1, 2009 – June 30, 2012) of fourth-high values for both the Ouray and Redwash monitors. Data from the 2012/2013 winter season are not available yet.
PM_{10}	24-hour	18.7	Average of the most recent three years available (2004 – 2006) of the Myton monitor. The Roosevelt monitor is not used as that monitor is located in a disturbed area in the City.
$PM_{2.5}$	24-hour	17.8	Average of the most recent three years available (July 1, 2009 – June 30, 2012) of eighth-high values (98th percentile) for both the Ouray and Redwash monitors.
	Annual	8.0	Average of the most recent three years available (July 1, 2009 - June 30, 2012) for both the Ouray and Redwash monitors.
SO_2	1-hour	20.1	Average of the most recent three years available (2007 – 2009) of fourth-high (99th percentile) values from the Sweetwater monitor. Although the Roosevelt monitor is more representative of the Uinta Basin, the data are not complete (only two months) and is not used.
	3-hour	14.3	Average of the most recent three years available (2007 – 2009) of second-high values from the Sweetwater monitor. Although the Roosevelt monitor is more representative of the Uinta Basin, the data are not complete (only two months) and is not used.

3.3 Acute and Chronic Hazardous Air Pollutants Exposure Thresholds

Hazardous Air Pollutants (HAPs) predicted to be released in meaningful quantities associated with the Proposed Action project include benzene, toluene, xylene, formaldehyde, and acrolein. Hydrogen sulfide (H_2S) is not expected to constitute a meaningful portion of the gas stream and therefore was not assessed. Since there are no applicable federal ambient air quality standards for HAPs, Reference Concentrations (RfC) for chronic inhalation exposure and Reference

Exposure Levels (REL) for acute inhalation exposures are used as evaluation criteria. The RfCs represent an estimate of the continuous (i.e. annual average) inhalation exposure rate to the human population (including sensitive subgroups such as children and the elderly) without adverse health effects. The RELs represent the acute (i.e. one-hour average) concentration at or below which no adverse health effects are expected. Both the RfC and REL guideline values are for non-cancer effects.

Values for the RfCs and RELs are provided in Table 3-4. The values in Table 3-4 are from the USEPA Air Toxics Database, Tables 1 and 2 (USEPA 2011a and USEPA 2012), except for acrolein. There is a wide range of RfCs published for acrolein, ranging from 0.02 µg/m^3 (USEPA 2012) to 250 µg/m^3 (OSHA 2013). Acrolein in air is rapidly removed by reacting with photochemically generated hydroxyl radicals, and the primary environmental exposure to acrolein comes from smoking and heating of fats and vegetable oils at high temperatures (ATSDR 2013). Acrolein is also present naturally in the body (ATSDR 2013). The USEPA RfC of 0.02 µg/m^3 was extrapolated from a Lowest Observed Adverse Effect Level (LOAEL) of 900 µg/m^3 (USEPA 2009) and the USEPA indicated that there is at least an order of magnitude uncertainty in the extrapolation. The California Office of Environmental Health Hazard Assessment (OEHHA) has thoroughly reviewed the toxicity of acrolein and published an RfC of 0.35 µg/m^3 (OEHHA 2013). Since the OEHHA value is near the lower end of the range of published RfCs and is not as uncertain as the USEPA value, the OEHHA value is used.

Table 3-4
HAP Reference Exposure Levels and Reference Concentrations

Hazardous Air Pollutant (HAP)	Reference Exposure Level [REL 1-hr Average] (µg/m^3)	Reference Concentration [RfC Annual Average] (µg/m^3)
Benzene	1,300	30
Toluene	37,000	5,000
Xylenes	22,000	100
Formaldehyde	55	9.8
Acrolein	2.5	0.35

In addition to the RELs and RfCs, the State of Utah has adopted Toxic Screening Levels (TSLs) which are used during the air permitting process to assist in the evaluation of hazardous air pollutants released into the atmosphere (Utah Department of Environmental Quality- Division of Air Quality, UDAQ 2011). The TSLs are derived from Threshold Limit Values (TLVs) published in the American Conference of Governmental Industrial Hygienists (ACGIH) – "Threshold Limit Values for Chemical Substances and Physical Agents" (American Conference of Governmental Industrial Hygienists 2012). These levels are not standards that must be met, but screening thresholds which if exceeded, would suggest that additional information is needed to evaluate potential health and environmental impacts. The TSLs are compared against modeled concentrations for averaging periods of 1-hour (short-term) and 24-hour (chronic).

Table 3-5 lists the TSLs for each applicable HAP. The TSLs in Table 3-5 are published by the Utah Department of Environmental Quality – Utah Division of Air Quality (UDAQ 2012).

Table 3-5
Utah Toxic Screening Levels (TSLs)

Pollutant and Averaging Time	Toxic Screening Levels ($\mu g/m^3$)
Benzene (24-hour)	18
Toluene (24-hour)	2,512
Xylenes (24-hour)	14,473
Formaldehyde (1-hour)	37
Acrolein (1-hour)	23

3.4 Incremental Cancer Risk

To assess long-term exposure from carcinogenic HAP emissions, traditional risk assessment methods are applied and the risk for the maximally exposed individual (MEI) and most likely exposure (MLE) are compared to the generally acceptable risk range of one additional cancer per one million exposed persons (1×10^{-6}) to one additional cancer per ten thousand exposed persons (1×10^{-4}) or 100 in a million (USEPA 1993). For the MEI risk, it is assumed that a person is exposed continuously (24 hours per day, 365 days per year) for the life of project. For the MLE risk, an adjustment was made for the amount of time a family stays at a residence (nine years) and for the portion of time spent away from the home (64 percent of the day) (USEPA 1997). It is further assumed that households are exposed to one-quarter of the maximum concentration the remaining (36 percent) of the time. Exposure adjustment factors of 0.571 for the MEI (40/70) and 0.095 for the MLE [(9/70)*((0.64*1) + (0.36*0.25))] are applied to the estimated cancer risk to account for the actual time that an individual could be exposed during a 70-year lifetime.

In addition to the exposure assumption, unit risk factors (URFs) are used to assess potential carcinogenic risk. The URFs are multiplied times the annual average concentration of the potentially carcinogenic HAP and the exposure adjustment factor to calculate the potential cancer risk. URFs are derived for a continuous 70-year exposure, and that is why the exposure adjustment factors must be used. URFs are based on the USEPA guidelines on carcinogen risk assessment that assume cancer risks exist at any dose, the so-called zero threshold assumption (USEPA 1986). More recent data show that there are some exceptions to this zero threshold assumption and thus URFs are over-stated; however it is still the default assumption (USEPA 2007). Therefore the URFs provide an upper bound carcinogenic risk.

The chronic inhalation cancer risk factors for benzene and formaldehyde are presented in Table 3-6.

Table 3-6
Carcinogenic Unit Risk Factors

Hazardous Air Pollutant	Carcinogenic Unit Risk Factor [Annual Inhalation Exposure] (1/µg/m^3)
Formaldehyde [a]	1.3×10^{-5}
Benzene [a]	2.2×10^{-6} to 7.8×10^{-6}

[a] USEPA Integrated Risk Information System (IRIS) database (USEPA 2008). A range of risk factors is published for benzene.

4 EMISSIONS

Five sets of emissions were calculated as part of the AQIA: Proposed Action Ultimate Development (Alternative A), Proposed Action Annual Development (Alternative A), No Action Alternative (Alternative B), Field-Wide Electrification (Alternative C), and Resource Protection (Alternative D).

Emissions occur during two primary phases of the Proposed Action and Alternatives: the development phase and the operations phase. The development phase includes emissions from the following activities:

- Construction
- Drilling
- Completion
- Interim Reclamation
- Wind Erosion

The operations or production phase includes emissions from:

- Pump unit engines
- Production heaters
- Well-site tanks
- Pneumatic controllers
- Fugitive emissions of volatile organic compounds
- Well-site truck loading emissions
- Well-site flares
- Operations vehicle fugitive dust and tailpipe emissions

In addition to the development and the operations phases, infrastructure must be built to serve the operating wells. Infrastructure emissions include emissions from the following activities:

- Water treatment facility oil tanks, fugitive emissions of volatile organic compounds and emissions from gas generators
- Gas Oil Separation Plants (GOSPs), including truck loading emissions

- Compressor station emissions, including engines, tanks, dehydrators, flares and fugitives
- Gas processing plant

In the following subsections, emissions from these activities are summarized by the development, production, and infrastructure phases. Details for emissions from the activities within these phases and details for how the emissions were calculated, including assumptions, are shown in the Appendices as noted. In the summary tables presented below, only the criteria pollutants, greenhouse gas pollutants (including global warming potential, GWP), and key hazardous air pollutants for which evaluation criteria have been established as discussed in Section 3 (i.e., benzene, toluene, xylene, formaldehyde, acrolein) and total HAPs are reported. However, all of the HAP emissions are shown in the referenced appendices. The emission estimates account for the ACEPMs and other environmental protection measures that Newfield will implement. All of the emissions are reported in short tons (2,000 pounds per ton). GWP is calculated with a value of 1.0 for carbon dioxide, 21 for methane, and 310 for nitrous oxide.

4.1 Alternative A: Proposed Action Ultimate Development

The Proposed Action will result in up to 5,750 oil and gas wells (3,250 oil, 2,500 gas) being developed and operated along with the required infrastructure as described in Section 2. In order to assess the ambient air quality impacts of the Proposed Action, a maximum emissions year calculation was prepared, assuming normal well drilling frequency (approximately 360 wells per year), and full production from all 5,750 wells and operation of the entire Proposed Action infrastructure. This emissions scenario is termed the Proposed Action Ultimate Development.

Table 4-1 summarizes the emissions for the Proposed Action Ultimate Development. Appendix A shows how the emissions were calculated, including the detailed calculation formulas and assumptions. Appendix A-1 shows emissions for the oil wells; Appendix A-2 shows emissions for the gas wells. The emission inventory for the Proposed Action includes the benefit of the ACEPMs and regulatory requirements under the recently promulgated (August 16, 2012) New Source Performance Standard for oil and gas operations (Oil and Gas NSPS) published as 40 CFR 60 Subpart OOOO. The emissions do not include the benefit of emission reductions that may be required under the State of Utah permitting guidance and State or Federal Implementation Plans (SIP or FIP) for the Uinta Basin, tribal New Source Review (NSR) programs that will be promulgated in the near future (late 2013 or 2014), nor additional mitigation that may be required under the Adaptive Management Strategy to mitigate potential adverse ozone formation. These programs will likely require additional emission reduction measures for the Proposed Action.

Table 4-1
Proposed Action Ultimate Development Emissions

Pollutant	Well Develop-ment (tpy)	Well Product-ion (tpy)	Infra-structure (tpy)	Total Emissions (tpy)	Well Develop-ment (tpy)	Well Product-ion (tpy)	Infra-structure (tpy)	Total Emissions (tpy)	Total Emissions (tpy)
Criteria Pollutants									
	Oil Wells				Gas Wells				Project Total
NO_x	129.6	1,809.7	981.0	2,920.2	668.6	511.1	1,590.2	2,769.9	5,690.1
CO	106.0	2,290.7	1,782.8	4,179.6	594.3	523.1	3,226.8	4,344.2	8,523.8
VOC	12.1	3,929.0	1,109.2	5,050.3	35.9	3,795.8	1,479.0	5,310.6	10,360.9
SO_2	0.2	3.9	2.8	6.9	1.2	2.9	3.4	7.5	14.4
PM_{10}	423.3	570.3	393.2	1,386.7	1,145.1	283.0	88.8	1,516.9	2,903.6
$PM_{2.5}$	46.0	224.1	95.6	365.8	128.4	61.8	60.9	251.2	617.0
Hazardous Air Pollutants									
	Oil Wells				Gas Wells				Project Total
Benzene	0.084	16.25	5.61	21.95	0.52	26.15	13.95	40.62	62.57
Toluene	0.031	12.01	3.93	15.98	0.19	48.84	10.89	59.92	75.90
Xylene	0.020	3.63	1.08	4.73	0.13	37.30	2.51	39.94	44.67
Formal-dehyde	0.0080	182.68	49.38	232.07	0.053	0.36	148.50	148.92	380.99
Acrolein	0.00080	25.71	5.40	31.12	0.0053	---	14.47	14.48	45.60
Total HAPs	0.26	446.77	107.16	554.19	1.05	211.21	238.28	450.54	1,004.73
Greenhouse Gases									
	Oil Wells				Gas Wells				Project Total
CO_2	18,776	780,830	597,890	1,397,495	116,923	602,127	714,145	1,433,195	2,830,690
CH_4	18.81	3,816	668	4,502	4.60	7,152	928	8,085	12,587
N_2O	0.15	1.47	1.11	2.73	0.93	1.13	1.34	3.40	6.13
GWP	19,218	861,421	612,256	1,492,895	117,308	752,679	734,054	1,604,041	3,096,936

4.2 Alternative A: Proposed Action Annual Development

It will require approximately 16 years for the Proposed Action Development to be completed. Accordingly, not only was an assessment made for the Proposed Action Ultimate Development, emissions were assessed on an annual basis for development after December 31, 2011 through December 31, 2022. This yields a ten-year view of how emissions will change on an annual basis. For the annual development assessment, only NO_x and VOC emissions were evaluated because the purpose of the Proposed Action Annual Development analysis was to determine when or if emissions of ozone precursors in the MBPA would substantially increase as the result of the Proposed Action compared to emissions of ozone precursors in the MBPA that would otherwise occur under the No Action Alternative.

Table 4-2 shows the annual development emission increases in the MBPA. The details for these emission calculations are shown in Appendix B. The emissions shown include the benefit of the Oil and Gas NSPS and the ACEPMs but do not include emission reductions that may be required under a SIP, FIP, or NSR programs that may be promulgated in the near future nor mitigation that may be required under the Adaptive Management Strategy to mitigate potential adverse ozone formation.

Table 4-2
Proposed Action Annual Development Emission Increases

1	2	3	4	5	6	7	8
Calendar Year	**Cumulative Net Change in NO_x from December 31, 2011** (tpy)	**Cumulative Net Change in VOC from December 31, 2011** (tpy)	**Cumulative Net Change in NO_x plus VOC from December 31, 2011** (tpy) (2+3)	**Cumulative Number of Oil Wells Added**	**Cumulative Number of Gas Wells Added**	**Cumulative Wells Shut In or Converted to Water Injection**	**Cumulative Net Change in Number of Oil and Gas Producing Wells from December 31, 2011** (5+6-7)
2012	-53	25	-28	187	0	200	-13
2013	-172	-603	-775	363	0	400	-37
2014	-311	-684	-995	559	0	600	-41
2015	-387	-545	-932	794	0	800	-6
2016	-320	-99	-415	1,038	0	950	88
2017	-149	580	431	1,281	0	950	331
2018	-16	1,383	1,367	1,524	0	950	574
2019	194	2,213	2,407	1,767	12	950	829
2020	378	3,086	3,464	2,010	24	950	1,084
2021	561	3,959	4,520	2,253	36	950	1,339
2022	745	4,833	5,578	2,496	48	950	1,594

4.3 Alternative B: No Action Alternative

Under the No Action Alternative, oil and gas development and production in the MBPA will continue to occur on state, private, and federal lands. An analysis date of December 31, 2012 was chosen to forecast how many additional wells would be developed in the MBPA. Such development includes 218 additional oil wells yet to be drilled and placed into production in the Castle Peak and Eight Mile Flat Oil and Gas Expansion (Castle Peak) project area, 23 additional oil wells to be developed under approved Master Development Plans (MDP) Numbers 17 through 22 and 25 that are outside the Castle Peak project area, and an additional 547 oil and gas wells (209 gas, 338 oil) to be developed on state and private land; for a total of 788 oil and gas wells to be developed after December 31, 2012.

The number of wells yet to be developed in the Castle Peak project area is based on the following:

- The EIS analyzed a total of 973 wells, but assumed that 150 would be converted into water injection wells, for a net of 823 producing oil wells.
- The August 2005 Record of Decision (ROD) only authorized a net total of 778 producing oil wells.
- As of December 31, 2011, Newfield reported that there were 560 producing oil wells in the Castle Peak project area (Newfield, 2012).
- Newfield reported that in the entire MBPA (which is a much greater area than the Castle Peak project area), in calendar year 2012, there would be a net reduction of approximately 17 wells (net of new wells and wells shut-in or converted to water injection). This is out of a total of several thousand wells in the MBPA.
- Therefore, it was assumed that the number of wells in the Castle Peak project area would remain unchanged in Calendar year 2012.
- Accordingly, there is a total of a net of 218 oil wells to be developed in the Castle Peak project area (778 authorized by the ROD minus 560 developed as of December 31, 2012).

The number of wells to be developed under the MDPs was calculated from the fact that MDPs 17 through 22 and 25 authorized a total of 146 wells to be developed after December 31, 2012, but all but 23 of those wells are in the Castle Peak project area and are included in those numbers. Thus only 23 additional wells will be developed under the MDPs.

Table 4-3 shows the emissions that could occur under the No Action Alternative and details for how the emissions were calculated are in Appendix C.

Table 4-3
No Action Alternative Emissions

Pollutant	Well Development (tpy)	Well Production (tpy)	Infrastructure (tpy)	Total Project Emissions (tpy)
Criteria Pollutants				
NO_x	931.2	661.4	224.7	1,817.3
CO	498.7	558.1	440.5	1,497.4
VOC	178.1	1,707.2	231.6	2,116.9
SO_2	1.0	1.3	0.5	2.8
PM_{10}	598.7	169.6	41.8	810.1
$PM_{2.5}$	89.6	53.4	13.9	157.0
Hazardous Air Pollutants				
Benzene	0.43	11.16	2.17	13.75
Toluene	0.16	26.29	1.60	28.04
Xylene	0.10	42.79	0.37	43.26
Formaldehyde	0.043	32.89	16.87	49.80
Acrolein	0.0043	4.62	1.70	6.33
Total HAPs	0.98	196.07	30.55	227.61
Greenhouse Gases				
CO_2	94,746	249,841	117,217	461,805
CH_4	27.21	1,503	156	1,686
N_2O	0.76	0.47	0.22	1.45
GWP	95,553	281,549	120,563	497,665

The emissions shown for the No Action Alternative do not include the benefit of the ACEPMs that Newfield will implement associated with the Proposed Action Alternative nor potential emission reductions under the Adaptive Management Strategy to mitigate potential adverse ozone formation because those measures will not be implemented if the No Action Alternative is selected. The estimates do include the benefit of the Oil and Gas NSPS as that regulation is applicable to future development. However, one of the main benefits of the NSPS is control on storage tanks with the potential to emit greater than 6 tons per year. Under the No Action Alternative, in the MBPA, if none of the ACEPMs contemplated under the Proposed Action are implemented, the storage tanks would have emissions less than the 6 tpy threshold and thus no controls would be applied. As in the case of the Proposed Action, the emission estimates shown in Table 4-3 do not include benefits from future SIP, FIP, and NSR programs that may be implemented in the region in the near future.

4.4 Alternative C: Field-Wide Electrification

In Alternative C, Newfield would implement field-wide electrification which would be phased in over an approximate 7-year period. The electrification would result in replacing natural gas fired pumpjack engines, compressor engines, and generators with electric motors. Emission estimates for the Proposed Action (i.e., 5,750 wells) when Alternative C has been completely implemented are shown in Table 4-4, with details shown in Appendix D. The infrastructure emissions in Table 4-4 include the 550 MWe of electrical generation that Newfield proposed to build under Alternative C. If commercial electrical energy is used, the emissions will decrease to the values shown in Table 4-5. As is the case for the Proposed Action, the emissions for Alternative C include the benefit of ACEPMs and the Oil and Gas NSPS, but do not include emission reductions that may be required under a SIP, FIP, or NSR programs that may be promulgated in the near future nor mitigation that may be required under the Adaptive Management Strategy to mitigate potential adverse ozone formation.

4.5 Alternative D: Resource Protection (Agency Preferred Alternative)

In Alternative D, 5,058 oil and gas wells would be developed in the MBPA. For purposes of analysis, it was assumed that 3,519 of the wells would be oil wells and 1,539 would be deep gas wells. Drilling and development would still occur at an average rate of 360 wells per year until the resource base is fully completed, approximately 14 years. Emission estimates for Alternative D are shown in Table 4-6, with details shown in Appendix E. Appendix E-1 shows the oil well emissions and E-2 the gas well emissions. As is the case for the Proposed Action, the emissions for Alternative D include the benefit of ACEPMs and the Oil and Gas NSPS, but do not include emission reductions that may be required under a SIP, FIP, or NSR programs that may be promulgated in the near future nor mitigation that may be required under the Adaptive Management Strategy to mitigate potential adverse ozone formation.

Table 4-4
Development Emissions Under Alternative C Field-Wide Electrification and Self-Generated Electrical Energy

Pollutant	Well Develop-ment (tpy)	Well Product-ion (tpy)	Infra-structure (tpy)	Total Emissions (tpy)	Well Develop-ment (tpy)	Well Product-ion (tpy)	Infra-structure (tpy)	Total Emissions (tpy)	Total Emissions (tpy)
Criteria Pollutants									
	Oil Wells				Gas Wells				Project Total
NO_x	129.6	344.6	250.1	724.3	668.6	511.1	90.8	1,270.5	1,994.8
CO	106.0	290.9	269.2	666.1	594.3	523.1	165.9	1,283.2	1,949.3
VOC	12.1	3,532.4	580.8	4,125.3	35.9	3,795.8	409.2	4,240.9	8,366.2
SO_2	0.2	2.0	2.0	4.1	1.2	2.9	1.2	5.3	9.4
PM_{10}	423.3	410.6	376.7	1,210.6	1,145.1	283.0	70.3	1,498.4	2,709.0
$PM_{2.5}$	46.0	64.4	79.1	189.6	128.4	61.8	42.4	232.7	422.3
Hazardous Air Pollutants									
	Oil Wells				Gas Wells				Project Total
Benzene	0.084	9.84	3.92	13.84	0.519	26.15	12.76	39.43	53.27
Toluene	0.031	8.83	3.91	12.78	0.188	48.84	10.63	59.66	72.44
Xylene	0.020	2.74	1.16	3.92	0.1290	37.30	2.44	39.86	43.78
Formal-dehyde	0.0080	0.25	4.21	4.47	0.0527	0.36	4.91	5.32	9.79
Acrolein	0.00080	---	0.037	0.038	0.00527	---	0.044	0.049	0.087
Total HAPs	0.26	183.91	41.53	225.69	1.05	211.21	42.23	254.48	480.17
Greenhouse Gases									
	Oil Wells				Gas Wells				Project Total
CO_2	18,776	394,514	1,018,246	1,431,536	116,923	602,127	983,856	1,702,905	3,134,441
CH_4	18.81	3,809	665	4,492	4.60	7,152	933	8,090	12,582
N_2O	0.15	0.74	1.90	2.80	0.93	1.13	1.85	3.91	6.71
GWP	19,218	474,727	1,032,792	1,526,737	117,308	752,679	1,004,029	1,874,015	3,400,752

Table 4-5
Development Emissions Under Alternative C Field-Wide Electrification with Commercial Electrical Energy

Pollutant	Well Develop-ment (tpy)	Well Product-ion (tpy)	Infra-structure (tpy)	Total Emissions (tpy)	Well Develop-ment (tpy)	Well Product-ion (tpy)	Infra-structure (tpy)	Total Emissions (tpy)	Total Emissions (tpy)
Criteria Pollutants									
	Oil Wells				Gas Wells				Project Total
NO_x	129.6	344.6	202.5	676.7	668.6	511.1	33.7	1,213.3	1,890.0
CO	106.0	290.9	225.8	622.6	594.3	523.1	113.7	1,231.1	1,853.7
VOC	12.1	3,532.4	564.2	4,108.7	35.9	3,795.8	389.4	4,221.1	8,329.8
SO_2	0.2	2.0	1.0	3.2	1.2	2.9	0.1	4.2	7.4
PM_{10}	423.3	410.6	344.8	1,178.7	1,145.1	283.0	32.1	1,460.2	2,638.9
$PM_{2.5}$	46.0	64.4	47.3	157.8	128.4	61.8	4.2	194.5	352.3
Hazardous Air Pollutants									
	Oil Wells				Gas Wells				Project Total
Benzene	0.084	9.84	3.85	13.77	0.519	26.15	12.68	39.35	53.12
Toluene	0.031	8.83	3.17	12.03	0.188	48.84	9.74	58.76	70.79
Xylene	0.020	2.74	0.79	3.55	0.1290	37.30	1.99	39.42	42.97
Formal-dehyde	0.0080	0.25	0.13	0.38	0.0527	0.36	0.01	0.43	0.81
Acrolein	0.00080	---	0.000	0.001	0.00527	---	0.000	0.005	0.006
Total HAPs	0.26	183.91	35.62	219.79	1.05	211.21	35.14	247.39	467.18
Greenhouse Gases									
	Oil Wells				Gas Wells				Project Total
CO_2	18,776	394,514	242,780	656,070	116,923	602,127	53,296	772,345	1,428,415
CH_4	18.81	3,809	650	4,477	4.60	7,152	916	8,073	12,550
N_2O	0.15	0.74	0.44	1.33	0.93	1.13	0.09	2.16	3.49
GWP	19,218	474,727	256,565	750,510	117,308	752,679	72,556	942,543	1,693,053

Table 4-6
Development Emissions Under Alternative D Resource Protection

Pollutant	Well Develop-ment (tpy)	Well Product-ion (tpy)	Infra-structure (tpy)	Total Emissions (tpy)	Well Develop-ment (tpy)	Well Product-ion (tpy)	Infra-structure (tpy)	Total Emissions (tpy)	Total Emissions (tpy)
Criteria Pollutants									
	Oil Wells				Gas Wells				Project Total
NO_x	153.3	2,137.3	468.8	2,759.4	472.8	315.0	1,353.7	2,141.5	4,900.9
CO	128.2	2,630.5	812.2	3,570.9	419.5	324.5	2,747.1	3,491.2	7,062.1
VOC	14.4	5,250.8	592.7	5,857.8	25.4	2,336.8	1,260.2	3,622.4	9,480.2
SO_2	0.2	5.3	1.5	7.0	0.9	1.8	2.9	5.5	12.5
PM_{10}	511.8	830.8	253.1	1,595.7	807.8	208.7	75.1	1,091.6	2,687.3
$PM_{2.5}$	55.0	276.1	57.8	388.8	90.7	41.5	51.9	184.2	573.0
Hazardous Air Pollutants									
	Oil Wells				Gas Wells				Project Total
Benzene	0.10	20.74	2.14	22.98	0.37	16.10	11.95	28.41	51.39
Toluene	0.039	15.91	1.34	17.29	0.13	30.06	9.32	39.52	56.81
Xylene	0.024	4.85	0.43	5.31	0.09	22.96	2.15	25.20	30.51
Formal-dehyde	0.0098	197.93	14.23	212.17	0.037	0.22	126.30	126.56	338.73
Acrolein	0.00098	27.84	1.81	29.66	0.0037	---	12.31	12.31	41.97
Total HAPs	0.32	543.44	43.33	587.09	0.74	130.02	202.86	333.62	920.71
Greenhouse Gases									
	Oil Wells				Gas Wells				Project Total
CO_2	22,950	1,049,077	315,150	1,387,177	82,477	370,729	608,232	1,061,438	2,448,615
CH_4	23.14	4,377	343	4,743	3.24	4,403	794	5,200	9,943
N_2O	0.189	1.98	0.58	2.75	0.657	0.70	1.14	2.50	5.25
GWP	23,495	1,141,609	322,527	1,487,631	82,749	463,409	625,260	1,171,418	2,659,049

5 IMPACT ASSESSMENT METHODOLOGY

Three different air quality impact assessments were conducted: Substantial Increase in Emissions Analysis, Near Field AQIA, and Far Field AQIA.

5.1 Substantial Increase in Emissions Analysis

In order to determine if implementation of the Proposed Action will result in a substantial increase in ozone precursor emissions, annual development emission increases in the MBPA for the Proposed Action were compared to emissions that would occur under the No Action Alternative in the MBPA. This analysis is discussed in Section 6 of this AQTSD.

5.2 Near Field AQIA

5.2.1 Dispersion Modeling

A dispersion model impact assessment was conducted to analyze the potential ambient air quality impacts of the Ultimate Proposed Action and Alternatives within 50 kilometers (km) of the project area, termed near field impacts. In order to conduct this analysis, the American Meteorological Society/Environmental Protection Agency Regulatory Model (AERMOD) version 12345, promulgated through the USEPA Guideline on Air Quality Models, was used as the primary dispersion model for assessing near-field impacts (40 CFR Part 51, Appendix W). The AERMOD system contains three primary components: AERMOD (dispersion model with prime building downwash algorithms), AERMAP (terrain preprocessor), and AERMET (meteorological preprocessor). A special feature of AERMOD includes the capability to represent boundary layer meteorology and dynamics. The USEPA Guideline on Air Quality Models (40 CFR Part 51, Appendix W) specifies that impacts calculated with steady-state Gaussian plume models (AERMOD) are recommended at distances up to 50 km from the origin of the emission source.

The AERMET system utilizes both surface and upper air measurements in order to estimate profiles of wind, turbulence, and temperature in the planetary boundary layer. Minimum meteorological data requirements in the surface and upper air data files for successful execution of AERMET include horizontal wind speed, horizontal wind direction, ambient temperature, cloud cover, and a morning upper air sounding. The recent version of the model, however, has incorporated the Bulk Richardson Number scheme which removes the model dependence on cloud cover if Solar Radiation and Temperature Change with Height (SRDT) data are available. This is especially important in areas where cloud cover data are unavailable or considered to be non-representative. After entering the surface and upper air data into AERMET, the surface characteristics that pertain to the meteorological data are required, including; Albedo, Bowen Ratio and Surface Roughness.

Another requirement for model performance is representative meteorological data of the conditions affecting the transport and dispersion of pollutants within the modeling domain. Generally, this means that the surface characteristics surrounding the meteorological monitoring site should be similar to those within the modeling domain. While a degree of similarity may correlate with proximity of the monitoring site to the project site, meteorological data measured at more distant sites may be considered representative as long as it adequately represents the meteorology and surface characteristics of the modeling domain.

In consideration of these limitations, this analysis utilized five recent calendar years of surface meteorological data from Vernal, Utah. The data were supplied by the Utah Department of Environmental Quality – Division of Air Quality (UDAQ) and consist of surface measurements collected in Vernal, Utah for the years 2005-2009 combined with upper air data recorded in Grand Junction, Colorado for the same years.

The data were created by UDAQ by using the AERMET processing program which utilized the surface and upper air data to produce two types of finished data files for each meteorological year for use by AERMOD; surface scalar parameters and vertical profiles. A profile base elevation of 1,608 m (5,276 ft.) was used with the meteorological data for the execution of AERMOD.

The wind rose for the processed meteorological data is shown on Figure 5-1 (all figures for Section 5 are located at the end of the Section).

Different emissions source configurations were used to evaluate the maximum potential near field impacts of the Proposed Action and Alternatives: one set for PM_{10} and $PM_{2.5}$ emissions and another set for NO_x, CO, SO_2, and HAPs emissions. The PM_{10} and $PM_{2.5}$ scenario is termed the Construction and Development Scenario as maximum particulate emissions occur during construction of well pads and roads in close proximity to operating wells. The NO_x, CO, SO_2 and HAPs emissions scenarios are termed Operations Scenarios since the potential maximum impacts of those emissions occurs when there is a combination of drilling and wells and infrastructure operating in close proximity. One set of the Operations Scenarios is based on 40-acre surface spacing of the gas well operations with associated infrastructure located in close proximity to the wells. Another set of Operations Scenarios is based on 40-acre surface spacing but 20-acre downhole spacing (i.e., two oil wells per pad) of oil well operations in close proximity to associated infrastructure. It is possible to have one oil well and one gas well on the same pad, however, the worst case configuration is two oil wells per pad.

In all three of the near field modeling scenarios, building downwash and terrain elevations were ignored (i.e., flat terrain was assumed) because of uncertainty in location and orientation of each source. This assumption is consistent with the fact that maximum impacts occur very close to the sources (since the sources are mostly ground level releases) and the terrain in the immediate vicinity of a source will be relatively flat. There are also relatively few buildings associated with these sources, so building downwash is not an issue.

Since most of the nitrogen oxide (NO_x) emissions are nitrogen monoxide (NO) rather than nitrogen dioxide (NO_2), an assumption regarding conversion of NO to NO_2 must be made. For the 1-hour NO_2 impact, the Tier 2 analytical method as described in the USEPA March 1, 2011 memorandum (USEPA 2011b) was used. The Tier 2 method assumes a constant 80 percent conversion of the emitted NO. For the annual NO_2 impact, 100 percent conversion of NO to NO_2 was assumed.

5.2.2 Proposed Action and Alternatives Evaluation

Five different modeling scenarios were evaluated in order to assess the potential ambient air quality impacts of the Proposed Action and Alternatives. The modeling scenarios were as follows:

- Alternative A – Proposed Action: Well construction and development
- Alternative A – Proposed Action: 20-acre downhole spacing oil well operations
- Alternative A – Proposed Action: 40-acre surface spacing gas well operations
- Alternative C – Field Wide Electrification: 20-acre downhole spacing oil well operations
- Alternative C – Field Wide Electrification: 40-acre surface spacing gas well operations

Construction and well development emissions are the same under all of the Action Alternatives, so only one modeling scenario is needed. Under the No Action Alternative (Alternative B), well construction, development and operations could still occur, but the emissions and sources would be similar to Alternative A, and the near field impacts would be the similar.

5.2.3 Construction and Development Modeling Scenario

The construction and development modeling scenario focuses on particulate matter emissions, PM_{10} and $PM_{2.5}$, primarily generated by earth-moving and traffic activities. In this scenario, a section of the well field is modeled as shown in Figure 5-2. This scenario is a worst-case configuration and is not likely to occur. Receptors were placed in a rectangular grid every 100 meters from the emitting sources. The scenario contains a portion of unpaved road with six (6) road branches. At the end of one branch is well pad construction, another branch contains well development (drilling) and the rest contain producing wells.

The point source release parameters used in the Construction and Development scenario are shown in Table 5-1. Well pad construction was modeled as an area source with dimensions of 75 meters by 108 meters for oil wells (2 acres) and dimensions of 110 meters by 110 meters for gas wells (3 acres). Unpaved road emission sources were modeled as volume sources assuming a 6.7 meter wide road. Table 5-1 shows the area and volume source release parameters.

Table 5-1
Source Release Parameters for Construction and Development

Activity	Stack height (m)	Temperature (K)	Exit Velocity (m/sec)	Stack Diameter (m)
Drill Rigs	6.1	800	50	0.2
Producing Well site	3.05	700	3.8	0.1
Activity	**Release Height (m)**	**Initial Horizontal Dimension (m)**	**Initial Vertical Dimension (m)**	
Well Pad Construction	3.05	N/A	1.5	
Unpaved Road Segments	4.6	7.79	2.13	

The emission rates for each of the sources were calculated differently for short term and annual impacts. The short term emission rates were calculated by dividing the maximum short term pounds per hour by 3,600 seconds. The annual emission rates were calculated by dividing the maximum annual emissions by the number of seconds in a year. Table 5-2 shows the modeled emission rates.

Table 5-2
Emission Rates for Construction and Development Sources

Equipment	PM_{10} Hourly (g/sec)	$PM_{2.5}$ Hourly (g/sec)	$PM_{2.5}$ Annual (g/sec)
Drill Rigs – Oil Wells	7.575E-03	7.575E-03	1.245E-04
Drill Rigs – Gas Wells	7.575E-03	7.575E-03	1.141E-03
Producing Wellsite – Oil Wells	1.977E-03	1.977E-03	1.977E-03
Producing Wellsite – Gas Wells	4.225E-04	4.225E-04	4.225E-04
Well Pad Construction – Oil Wells	4.742E-02	2.607E-02	2.157E-04
Well Pad Construction – Gas Wells	4.742E-02	2.607E-02	2.166E-04
Unpaved Road Segments – Oil Wells	3.611E-03	3.611E-04	8.062E-05
Unpaved Road Segments – Gas Wells	2.887E-03	2.887E-04	7.235E-05

5.2.4 Modeling Scenario for 20-Acre Downhole Spacing Oil Operations, Alternative A

The 20-acre downhole spacing modeling scenario for oil well operations is shown in Figure 5-3. This scenario is a worst-case configuration and not likely to occur. Receptors were placed in a rectangular grid every 100 meters from the emitting sources. All emitting sources were modeled as point sources, with each well pad placed 40-acres apart (surface spacing). Most well pads contain two producing wells; however the four well pads in the center of the grid contain one well being drilled and one producing well. Additionally, the grid contains one compressor station and one GOSP facility just to the south of the drilling well pads. The point source release parameters used in this scenario for NO_2, SO_2, and CO are shown in Table 5-3, while the point source release parameters used in this scenario for the HAPs are shown in Table 5-4. For the HAP scenario either a GOSP or a Water Treatment Facility was placed in the grid depending on which facility would have higher emissions for a specific HAP.

Table 5-3
Point Source Release Parameters for 20-Acre Downhole Spacing Oil Operations -- Alternative A – NO_2, SO_2, and CO

Equipment	Stack height (m)	Temperature (K)	Exit Velocity (m/sec)	Stack Diameter (m)
Compressor Engines	10.67	730	49.7	0.305
Compressor Station Heater	3.66	570	3.8	0.2
Compressor Station and GOSP Flares	6.10	1273	2.0	0.61
GOSP Generator	9.14	755	27.0	0.305
GOSP Heater	7.32	570	2.6	0.61
Drill Rigs	6.10	800	50.0	0.2
Producing Well sites	3.05	700	3.8	0.1

Table 5-4
Point Source Release Parameters for 20-Acre Downhole Spacing Oil Operations -- Alternative A – Hazardous Air Pollutants

Equipment	Stack height (m)	Temperature (K)	Exit Velocity (m/sec)	Stack Diameter (m)
Producing Well sites	3.05	700	3.8	0.1
Drill Rigs	6.10	800	50.0	0.2
Compressor Engines	10.67	730	49.7	0.305
Compressor Station Tanks, Fugitives, Dehydrator	6.10	1273	2	0.61
Compressor Station Heater	3.66	570	3.8	0.2
GOSP Generator	9.14	755	27	0.305
GOSP Fugitives, Loading	1.52	350	0.5	0.1
GOSP Heater	7.32	570	2.6	0.61
Water Treatment Generator	9.14	755	27.0	0.305
Water Treatment Tanks, Fugitives	8.23	350	0.5	0.1

The emission rates for each of the sources were calculated differently for short term and annual impacts for NO_2, SO_2, and CO. The short term emission rates were calculated by dividing the maximum short term pounds per hour by 3,600 seconds. The annual emission rates were calculated by dividing the maximum annual emissions by the number of seconds in a year. For HAPs, the maximum pounds per hour were divided by 3,600 seconds for all emissions. Table 5-5 presents the modeled emission rates for NO_2, SO_2, and CO and Table 5-6 presents the modeled emission rates for HAPs.

Table 5-5
Emission Rates for 20-Acre Downhole Spacing Oil Operations -- Alternative A – NO_2, SO_2, and CO

Equipment	NO_2 Annual (g/sec)	NO_2 Hourly (g/sec)	CO Hourly (g/sec)	SO_2 Hourly (g/sec)
Compressor Engines	2.222	2.222	4.444	0.00474
Compressor Station Heater	0.0185	0.0185	0.0156	0.000111
Compressor Station and GOSP Flares	0.0257	0.0257	0.140	----
GOSP Generator	0.540	0.540	1.081	0.00130
GOSP Heater	0.408	0.408	0.342	0.00245
Drill Rigs	0.0108	0.656	0.656	0.00139
Producing Well sites	0.0205	0.0205	0.0247	0.0000617

Table 5-6
Emission Rates for 20-Acre Downhole Spacing Oil Operations -- Alternative A – Hazardous Air Pollutants

Equipment	Benzene Maximum (g/sec)	Formaldehyde Maximum (g/sec)	Acrolein Maximum (g/sec)
Producing Well sites	3.134E-04	1.620E-03	2.276E-04
Drill Rigs	6.221E-04	6.325E-05	6.317E-06
Compressor Engines	1.774E-03	2.129E-01	2.072E-02
Compressor Station Tanks, Fugitives, Dehydrator	1.743E-02	----	----
Compressor Station Heater	3.891E-07	1.390E-05	----
GOSP Generator	1.742E-03	2.261E-02	2.900E-03
GOSP Fugitives, Loading	1.186E-03	----	----
GOSP Heater	8.560E-06	3.057E-04	----
Water Treatment Generator	1.742E-03	2.261E-02	2.900E-03
Water Treatment Tanks, Fugitives	2.052E-03	----	----

5.2.5 Modeling Scenario for 40-Acre Surface Spacing Gas Operations, Alternative A

The 40-acre surface spacing modeling scenario for gas well operations is shown in Figure 5-4. This scenario is a worst-case configuration and not likely to occur. Receptors were placed in a rectangular grid every 100 meters from the emitting sources. All emitting sources were modeled as point sources, with each well pad placed 40-acres apart (surface spacing). Most well pads contain one producing well; however the four well pads in the center of the grid contain one well being drilled. Additionally, the grid contains one compressor station and one gas processing facility just to the south of the drilling well pads. The point source release parameters used in this scenario for NO_2, SO_2, and CO are shown in Table 5-7, while the point source release parameters used in this scenario for the HAPs are shown in Table 5-8.

Table 5-7
Point Source Release Parameters for 40-Acre Surface Spacing Gas Operations -- Alternative A – NO_2, SO_2, and CO

Equipment	Stack height (m)	Temperature (K)	Exit Velocity (m/sec)	Stack Diameter (m)
Producing Well	3.05	700	3.8	0.1
Drill Rig	6.10	800	50.0	0.2
Compressor Engines	10.67	730	49.7	0.305
Compressor Station Heater	3.66	570	3.8	0.2
Compressor Station and Gas Plant Flares	6.10	1273	2.0	0.61
Gas Plant Engines	7.32	1013	35.2	0.15
Gas Plant Heater	3.66	570	3.8	0.2

Table 5-8
Point Source Release Parameters for 40-Acre Surface Spacing Gas Operations -- Alternative A – Hazardous Air Pollutants

Equipment	Stack height (m)	Temperature (K)	Exit Velocity (m/sec)	Stack Diameter (m)
Producing Well	3.05	700	3.8	0.1
Drill Rigs	6.10	800	50.0	0.2
Compressor Engines	10.67	730	49.7	0.305
Comp Station Tanks, Fugitives, Dehydrator	6.10	1273	2.0	0.61
Compressor Station Heater	3.66	570	3.8	0.2
Gas Plant Engines	7.32	1013	35.2	0.15
Gas Plant Dehydrator, Fugitives	6.10	1273	2.0	0.61
Gas Plant Heater	3.66	570	3.8	0.2

The emission rates for each of the sources were calculated differently for short term and annual impacts for NO_2, SO_2, and CO. The short term emission rates were calculated by dividing the maximum short term pounds per hour by 3,600 seconds. The annual emission rates were calculated by dividing the maximum annual emissions by the number of seconds in a year. For HAPs, the maximum pounds per hour were divided by 3,600 seconds for all emissions. Table 5-9 presents the modeled emission rates for NO_2, SO_2, and CO and Table 5-10 presents the modeled emission rates for HAPs.

Table 5-9
Emission Rates for 40-Acre Downhole Spacing Gas Operations -- Alternative A – NO_2, SO_2, and CO

Equipment	**NO_2 Annual** (g/sec)	**NO_2 Hourly** (g/sec)	**CO Hourly** (g/sec)	**SO_2 Hourly** (g/sec)
Producing Well	0.00579	0.00579	0.00593	0.0000334
Drill Rig	0.0989	0.656	0.656	0.00139
Compressor Engines	2.222	2.222	4.444	0.00474
Compressor Station Heater	0.0185	0.0185	0.0156	0.000111
Compressor Station and Gas Plant Flares	0.0257	0.0257	0.140	----
Gas Plant Engines	0.333	0.333	0.167	0.000200
Gas Plant Heater	0.0185	0.0185	0.0156	0.000111

Table 5-10
Emission Rates for 40-Acre Downhole Spacing Gas Operations --
Alternative A – Hazardous Air Pollutants

Equipment	Benzene Maximum (g/sec)	Formaldehyde Maximum (g/sec)	Acrolein Maximum (g/sec)
Producing Well	3.009E-04	4.169E-06	----
Drill Rigs	6.221E-04	6.325E-05	6.317E-06
Compressor Engines	1.774E-03	2.129E-01	2.072E-02
Compressor Station Tanks, Fugitives, Dehydrator	1.743E-02	----	----
Compressor Station Heater	3.891E-07	1.390E-05	----
Gas Plant Engines	1.075E-03	1.395E-02	1.789E-03
Gas Plant Dehydrator, Fugitives	1.613E-02	----	----
Gas Plant Heater	3.891E-07	1.390E-05	----

5.2.6 Modeling Scenario for 20-Acre Downhole Spacing Oil Operations, Alternative C

The 20-acre downhole spacing modeling scenario for oil well operations is shown in Figure 5-5. This scenario is a worst-case configuration and not likely to occur. Receptors were placed in a rectangular grid every 100 meters from the emitting sources. All emitting sources were modeled as point sources, with each well pad placed 40-acres apart (surface spacing). Most well pads contain two producing wells; however the four well pads in the center of the grid contain one well being drilled and one producing well. Additionally, the grid contains one compressor station, one GOSP facility, and one electric substation just to the south of the drilling well pads. The point source release parameters used in this scenario for NO_2, SO_2, and CO are shown in Table 5-11, while the point source release parameters used in this scenario for the HAPs are shown in Table 5-12. For the HAP scenario either a GOSP or a Water Treatment Facility was placed in the grid depending on which facility would have higher emissions for a specific HAP.

Table 5-11
Point Source Release Parameters for 20-Acre Downhole Spacing Oil Operations -- Alternative C – NO_2, SO_2, and CO

Equipment	Stack height (m)	Temperature (K)	Exit Velocity (m/sec)	Stack Diameter (m)
Producing Well	3.05	700	3.8	0.1
Drill Rigs	6.10	800	50.0	0.2
Turbines	9.14	736	50.2	1.07
GOSP Heater	7.32	570	2.6	0.61
Compressor Station and GOSP Flares	6.10	1273	2.0	0.61
Compressor Station Heater	3.66	570	3.8	0.2

Table 5-12
Point Source Release Parameters for 20-Acre Downhole Spacing Oil Operations -- Alternative C – Hazardous Air Pollutants

Equipment	Stack height (m)	Temperature (K)	Exit Velocity (m/sec)	Stack Diameter (m)
Turbines	9.14	736	50.2	1.07
Producing Well	3.05	700	3.8	0.1
Drill Rigs	6.10	800	50.0	0.2
Compressor Station Tanks, Fugitives, Dehydrator	6.10	1273	2.0	0.61
Compressor Station Heater	3.66	570	3.8	0.2
GOSP Fugitives, Loading	1.52	350	0.5	0.1
GOSP Heater	7.32	570	2.6	0.61
WT Tanks, Fugitives	8.23	350	0.5	0.1

The emission rates for each of the sources were calculated differently for short term and annual impacts for NO_2, SO_2, and CO. The short term emission rates were calculated by dividing the maximum short term pounds per hour by 3,600 seconds. The annual emission rates were calculated by dividing the maximum annual emissions by the number of seconds in a year. For HAPs, the maximum pounds per hour were divided by 3,600 seconds for all emissions. Table 5-13 presents the modeled emission rates for NO_2, SO_2, and CO and Table 5-14 presents the modeled emission rates for HAPs.

Table 5-13
Emission Rates for 20-Acre Downhole Spacing Oil Operations -- Alternative C – NO_2, SO_2, and CO

Equipment	NO_2 Annual (g/sec)	NO_2 Hourly (g/sec)	CO Hourly (g/sec)	SO_2 Hourly (g/sec)
Producing Well	0.00755	0.00755	0.00698	0.0000445
Drill Rigs	0.0108	0.656	0.656	0.00139
Turbines	0.274	0.274	0.250	0.00534
GOSP Heater	0.408	0.408	0.342	0.00245
Compressor Station and GOSP Flares	0.0257	0.0257	0.140	----
Compressor Station Heater	0.0185	0.0185	0.0156	0.000111

Table 5-14
Emission Rates for 20-Acre Downhole Spacing Oil Operations -- Alternative C – Hazardous Air Pollutants

Equipment	Benzene Maximum (g/sec)	Formaldehyde Maximum (g/sec)	Acrolein Maximum (g/sec)
Turbines	3.970E-04	2.349E-02	2.118E-04
Producing Well	2.567E-04	5.559E-06	----
Drill Rigs	6.221E-04	6.325E-05	6.317E-06
Compressor Station Tanks, Fugitives, Dehydrator	1.743E-02	----	----
Compressor Station Heater	3.891E-07	1.390E-05	----
GOSP Fugitives, Loading	1.186E-03	----	----
GOSP Heater	8.560E-06	3.057E-04	----
WT Tanks, Fugitives	2.052E-03	----	----

5.2.7 Modeling Scenario for 40-Acre Surface Spacing Gas Operations, Alternative C

The 40-acre surface spacing modeling scenario for gas well operations is shown in Figure 5-6. This scenario is a worst-case configuration and not likely to occur. Receptors were placed in a rectangular grid every 100 meters from the emitting sources. All emitting sources were modeled as point sources, with each well pad placed 40-acres apart (surface spacing). Most well pads contain one producing well; however the four well pads in the center of the grid contain one well being drilled. Additionally, the grid contains one compressor station, one gas processing facility, and one electric substation just to the south of the drilling well pads. The point source release parameters used in this scenario for NO_2, SO_2, and CO are shown in Table 5-15, while the point source release parameters used in this scenario for the HAPs are shown in Table 5-16.

Table 5-15
Point Source Release Parameters for 40-Acre Surface Spacing Gas Operations -- Alternative C – NO_2, SO_2, and CO

Equipment	Stack height (m)	Temperature (K)	Exit Velocity (m/sec)	Stack Diameter (m)
Producing Well	3.05	700	3.8	0.1
Drill Rig	6.10	800	50.0	0.2
Turbines	9.14	736	50.2	1.07
Gas Plant Heater	3.66	570	3.8	0.2
Compressor Station and Gas Plant Flare	6.10	1273	2.0	0.61
Compressor Station Heater	3.66	570	3.8	0.2

Table 5-16
Point Source Release Parameters for 40-Acre Surface Spacing Gas Operations -- Alternative C – Hazardous Air Pollutants

Equipment	Stack height (m)	Temperature (K)	Exit Velocity (m/sec)	Stack Diameter (m)
Producing Well	3.05	700	3.8	0.1
Drill Rig	6.10	800	50.0	0.2
Turbines	9.14	735.93	50.2	1.07
Gas Plant Heater	3.66	570	3.8	0.2
Gas Plant Dehydrator, Fugitives	6.10	1273	2.0	0.61
Compressor Station Tanks, Fugitive, Dehydrator	6.10	1273	2.0	0.61
Compressor Station Heater	3.66	570	3.8	0.2

The emission rates for each of the sources were calculated differently for short term and annual impacts for NO_2, SO_2, and CO. The short term emission rates were calculated by dividing the maximum short term pounds per hour by 3,600 seconds. The annual emission rates were calculated by dividing the maximum annual emissions by the number of seconds in a year. For

HAPs, the maximum pounds per hour were divided by 3,600 seconds for all emissions. Table 5-17 presents the modeled emission rates for NO_2, SO_2, and CO and Table 5-18 presents the modeled emission rates for HAPs.

Table 5-17
Emission Rates for 40-Acre Downhole Spacing Gas Operations -- Alternative C – NO_2, SO_2, and CO

Equipment	NO_2 Annual (g/sec)	NO_2 Hourly (g/sec)	CO Hourly (g/sec)	SO_2 Hourly (g/sec)
Producing Well	0.00579	0.00579	0.00593	0.0000334
Drill Rig	0.0989	0.656	0.656	0.00139
Turbines	0.274	0.274	0.250	0.00534
Gas Plant Heater	0.0185	0.0185	0.0156	0.000111
Compressor Station and Gas Plant Flare	0.0257	0.0257	0.140	----
Compressor Station Heater	0.0185	0.0185	0.0156	0.000111

Table 5-18
Emission Rates for 40-Acre Downhole Spacing Gas Operations -- Alternative C – Hazardous Air Pollutants

Equipment	Benzene Maximum (g/sec)	Formaldehyde Maximum (g/sec)	Acrolein Maximum (g/sec)
Producing Well	3.009E-04	4.169E-06	----
Drill Rig	6.221E-04	6.325E-05	6.317E-06
Turbines	3.970E-04	2.349E-02	2.118E-04
Gas Plant Heater	3.891E-07	1.390E-05	----
Gas Plant Dehydrator, Fugitives	1.613E-02	----	----
Compressor Station Tanks, Fugitive, Dehydrator	1.743E-02	----	----
Compressor Station Heater	3.891E-07	1.390E-05	----

5.2.8 Near Field Evaluation Criteria

The modeled impacts for criteria pollutants were added to the pre-project background concentrations shown in Table 3-3 and compared to the NAAQS shown in Table 3-1. The modeled impacts for potential non-carcinogenic HAPs were compared to the RELs and RfCs shown in Table 3-4 and the State of Utah TSLs shown in Table 3-5. Potential carcinogenic risk was calculated as discussed in Section 3.4 and compared to the standard acceptable risk range of 1 to 100 in a million. As shown in Tables 3-4 and 3-5, the three HAPs with the most stringent REL and RfCs are benzene, formaldehyde, and acrolein; and only benzene and formaldehyde are potentially carcinogenic. Accordingly, only benzene, formaldehyde, and acrolein impacts were modeled in the Near Field assessment; although all of the HAP emissions were quantified and are included in the Appendices.

5.3 Far Field AQIA

5.3.1 Dispersion Modeling

To assess the potential impacts of the Proposed Action and Alternatives on distant (i.e., greater than 50 km) receptors at Class I areas, sensitive Class II areas, and sensitive lakes, the CALPUFF modeling system (Version 5.8) was used. The CALPUFF modeling system consists of three major modules, CALMET, CALPUFF, and CALPOST. For the far field AQIA, only the CALPUFF (Version 5.8, Level 070623) and CALPOST (Version 6.221, Level 080724) modules were used. The CALMET module was not needed as the WRF (Weather Research and Forecasting meteorological model) meteorological data prepared for the Air Resource Management Strategy (ARMS) photochemical modeling project currently being conducted by the BLM were used. When appropriate, the CALPUFF and CALPOST modeling procedures in the Federal Land Manager's Air Quality Related Values Work Group (FLAG) October 2010 guidance (FLAG 2010) were used, including the updated Method 8 equations for regional haze impact assessments. Default settings were used in CALPUFF and CALPOST if not otherwise specified by the FLAG guidance. The WRF data were made "CALPUFF ready" by processing with the MMIF processor (Version 2.3). The MMIF processor simply re-formats the meteorological data to be useable in CALPUFF without any adjustments or supplementary meteorological observations.

The CALPUFF modeling domain covered eastern Utah and western Colorado as shown in Figure 5-7. The modeling domain was the same as used in the Greater Natural Buttes FEIS (BLM 2012) and extended 672 km east-west and 552 km north-south. The central reference point for the Lambert Conformal Projection (LCP) was 97 degrees west, 40 degrees north. The LCP standard parallels were 33 and 45 degrees north. The southwest corner of the modeling domain was located 1,392 km west of the central reference point and 312 km south of the central reference point. The modeling domain was a 4 km grid with 168 x 138 grid cells.

The WRF meteorological data utilize two different domains, a 4 km domain and a 12 km domain. The WRF 4 km domain does not include all of the Class I, sensitive Class II, and sensitive lake receptors evaluated herein. Accordingly, the far field impact assessment was completed with the 12 km domain. However, the 12 km domain results for visibility and NO_2 impacts for Arches National Park and Dinosaur National Monument were compared to the 4 km domain results and it was found that the 4 km domain results were the same or slightly lower than the 12 km domain results. Therefore, the 12 km domain was used for all of the far field impact assessments.

The list of Class I areas, sensitive Class II areas, and sensitive lakes are shown in Table 5-19. Locations of these areas with respect to the MBPA are shown in Figure 5-8.

The receptor grids for the Class I areas were those specified by the Federal Land Managers. Receptor grids were developed for the sensitive Class II areas based on the boundary of the area and a rectangular receptor grid at approximately 1.5 km spacing within the area. Single receptors at the center of each the sensitive lakes was used. Elevations for the receptors were developed where necessary from the USGS Shuttle Radar Topography Mission data with 30 meter with 90 meter resolution (USGS 2013).

Table 5-19
Class I Areas, Sensitive Class II Areas, and Sensitive Lakes Evaluated

Class I and Sensitive Class II Areas	Sensitive Lakes	
National Park Service (NPS) Class I Areas	**Eagles Nest Wilderness**	**High Uintas Wilderness**
Arches National Park	Booth Lake	Dean Lake
Black Canyon of the Gunnison National Park	Upper Willow Lake	Fish Lake
Canyonlands National Park	**Flat Tops Wilderness**	**Raggeds Wilderness**
Capitol Reef National Park	Ned Wilson Lake	Deep Creek Lake
Great Sand Dunes National Park and Preserve	Trappers Lake	Island Lake
Mesa Verde National Park	Upper Ned Wilson Lake	
USFS Class I Areas	**La Garita Wilderness**	
Eagles Nest Wilderness Area	Small Lake Above U-Shaped Lake	
Flat Tops Wilderness Area	U-Shaped Lake	
La Garita Wilderness Area	**Maroon Bells-Snowmass Wilderness**	
Maroon Bells-Snowmass Wilderness Area	Avalanche Lake	
Mount Zirkel Wilderness Area	Capitol Lake	
Weminuche Wilderness Area	Moon Lake (Upper)	
West Elk Wilderness Area	**Mount Zirkel Wilderness**	
NPS Class II Areas	Lake Elbert	
Colorado National Monument	Summit Lake	
Dinosaur National Monument	**Weminuche Wilderness**	
USFS Class II Areas	Big Eldorado Lake	
Flaming Gorge National Recreation Area	Little Eldorado Lake	
High Uintas Wilderness Area	Lower Sunlight Lake	
Holy Cross Wilderness Area	Upper Grizzly Lake	
Hunter/Frying Pan Wilderness Area	Upper Sunlight Lake	
Raggeds Wilderness Area	White Dome Lake	
U.S. Fish and Wildlife Service Class II Areas	**West Elk Wilderness**	
Browns Park National Wildlife Refuge	South Golden Lake	

5.3.2 Proposed Action and Alternatives Evaluation

The far field impact analysis included only NO_x, SO_2, PM_{10}, and $PM_{2.5}$. CO was not modeled because there are no PSD increments for CO and CO impacts are a local, near field issue. Similarly for HAP emissions, the impact of interest is local. For the far field impact evaluation only Alternative A was modeled. This Alternative has the largest emissions of any of the Alternatives and thus yields the maximum impact of any of the Alternatives.

Since the Class I areas, sensitive Class II areas and sensitive lakes are all located a considerable distance from the MBPA, the emissions for the entire Alternative A were placed into a single rectangular area source that can be fit within the MBPA. This is a rectangular source of 11 km by 13 km. The emissions were then calculated as grams per second per square meter (g/sec-m^2) by dividing the maximum tons per year by the number of seconds in a year and the area of the source. A single set of emission rates can be used for both short and long term impacts because most of the sources emit continuously at the same rate (e.g., a pumpjack engine runs continuously at the same load). The sources emit at essentially ground level, so the release height for the area source was set as ground level at the average elevation of the MBPA, 1432 meters above mean sea level. The modeled emission rates are shown in Table 5-20.

Table 5-20
Far Field Modeling Emission Rates

	NO_x (g/sec-m^2)	**SO_2** (g/sec-m^2)	**PM_{10}** (g/sec-m^2)	**$PM_{2.5}$** (g/sec-m^2)
CALPUFF Modeled Emission Rates	4.8E-07	1.20E-09	2.45E-07	5.20E-08

5.3.3 Far Field Evaluation Criteria

As a point of information only, the impacts of the Proposed Action in the Class I and sensitive Class II areas were compared to the PSD increments for the pollutants and averaging times for which increments have been established by the USEPA as shown in Table 3-1. As indicated in Section 3, comparisons with PSD increments are intended as a point of reference only and do not represent a regulatory PSD increment consumption analysis

For regional haze, the potential change in light extinction (b_{ext}) in terms of change in deciviews (dV) was evaluated using the CALPUFF Method 8 and the regional haze equations suggested by FLAG in the 2010 guidance (FLAG 2010). Method 8 and the FLAG 2010 guidance treat large sulfate and small sulfate separately because large and small particles affect light extinction differently. The modeled impacts were evaluated by calculating the number of days in each area that exceeded the 0.5 dV and 1.0 dV thresholds of concern used by USEPA in its Regional Haze regulations and the eighth-high (98th percentile) change in bext compared to the 0.5 dV threshold published by the Federal Land Managers (FLAG 2010).

Acid deposition was evaluated by calculating total sulfur and nitrogen deposition (dry plus wet) from the CALPUFF model output (in terms of kilograms sulfur or nitrogen per hectare per year, kg/ha-yr). The deposition was compared to the 3 kg/ha-yr and 5 kg/ha-yr thresholds for nitrogen and sulfur, respectively.

For sensitive lakes, the change in acid neutralizing capacity (ANC) was calculated using the methodology suggested by the US Forest Service (USFS 2000). The method is to calculate hydrogen ion deposition (H_{dep}) in terms of micro equivalents per liter (µeq/l) from the watershed area and total sulfur and nitrogen deposition of all species output by CALPUFF. The watershed areas were those used in the GNB analysis (BLM 2012) and were provided by the Federal Land Managers. H_{dep} is compared to the baseline ANC (ANC(o)), also reported in the GNB analysis as provided by the Federal Land Managers. The change in ANC was compared to the threshold of a 10 percent change in ANC for lakes with background ANC values greater than 25 µeq/l and no more than a 1 µeq/l change in ANC for lakes with background ANC values equal to or less than 25 µeq/l.

Figure 5-1: Wind Rose for Vernal, Utah

Figure 5-2: Construction and Development Modeling Scenario Configuration

Figure 5-3: Alternative A 40-acre Spacing Modeling Scenario Configuration

Figure 5-4: Alternative A 20-acre Spacing Modeling Scenario Configuration

Figure 5-5: Alternative C 40-acre Spacing Modeling Scenario Configuration

Figure 5-6: Alternative C 20-acre Spacing Modeling Scenario Configuration

Figure 5-7: CALPUFF Modeling Domains

Figure 5-8: Location of Analyzed Sensitive Lakes

6 SUBSTANTIAL INCREASE IN EMISSIONS EVALUATION

6.1 Emission Increases

To determine if the Proposed Action and Alternatives could result in a substantial increase in ozone precursor emissions, the projected annual development emissions in Table 4-2 were compared to the No Action Alternative emissions shown in Table 4-3. The results are summarized in Table 6-1 and shown graphically in Figures 6-1 through 6-3 which are located at the end of this Section. Figure 6-1 shows this comparison for the projected NO_x emissions, Figure 6-2 shows the projected VOC emissions, and Figure 6-3 shows the sum of NO_x plus VOC emissions.

Table 6-1
Comparison of Annual Proposed Action Development Emission Increases Compared to No Action Development Emission Increases
(tons per year)

Year	Annual Development Proposed Action Projected Annual NO_x Increases	NO_x Emission Increases under No Action Alternative (from Table 4-3) [a]	Annual Development Proposed Action Projected Annual VOC Increases	VOC Emission Increases under No Action Alternative (from Table 4-3) [a]	Annual Development Proposed Action Projected Annual NO_x + VOC Increases	NO_x + VOC Emission Increases under No Action Alternative (from Table 4-3) [a]
2012	-53	1,817 [b]	25	2,117 [b]	-28	3,934 [b]
2013	-172		-603		-775	
2014	-311		-684		-995	
2015	-387		-545		-932	
2016	-320		-99		-415	
2017	-149		580		431	
2018	-16		1,383		1,367	
2019	194		2,213		2,407	
2020	378		3,086		3,464	
2021	561		3,959		4,520	
2022	745		4,833		5,578	

[a] The No Action Alternative analysis date was chosen as December 31, 2012. The annual development projections provided by Newfield used an analysis date of December 31, 2011. However, as the table shows, there is essentially no difference in emissions for calendar year 2012 (less than 0.5 percent of the total NOx plus VOC).
[b] The No Action Alternative emissions increase will occur during the first two to three years and then remain constant (because no more wells could be developed under the No Action Alternative). It is not known what the rate of emission increases could be under the No Action Alternative, thus the emission increases have been presented as a single value in the Table.

By December 31, 2022, Newfield could develop up to a net of 1,594 additional oil and gas wells in the MBPA. Table 6-2 shows the emissions and activities for the Proposed Action development by calendar 2022 compared to the No Action Alternative. Development of the Proposed Action can continue into approximately early calendar year 2021 for total ozone precursor (NOx plus VOC) emissions, late 2019 for VOC emissions alone, and beyond 2022 for NOx emissions alone without causing an increase greater than the No Action Alternative. Under the Proposed Action, emissions of NOx will decrease until about calendar year 2019 and then increase but will remain less than the No Action Alternative until at least 2022. VOC emissions will also decrease under the Proposed Action through about 2016, but by about 2019 will exceed emissions that would occur under the No Action Alternative. The reason development of this magnitude could occur without a substantial increase in total ozone precursor emissions is because Newfield will implement a number of emission reducing measures in the MBPA that reduce emissions from existing and future oil and gas wells. These measures include the Applicant Committed Environmental Protection Measures (ACEPMs) and the following:

- By year 2022, it is expected that all of the old pumpjack engines in the MBPA will have been replaced with newer low emitting engines.
- At the end of 2022, it is projected that there will be 1,138 oil wells in the MBPA that will be sharing storage tanks and those tanks will have emission controls.
- A projected total of 150 additional oil wells will be routed to a Gas Oil Separator Plant (GOSP), where emissions from the storage tanks are controlled 100 percent.
- Tier 4 drill rig engines will be used in 2022.
- It is anticipated that gas associated with oil development can be processed by the existing infrastructure through 2022.

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Table 6-2
Annual Development and Production Emissions for Calendar Year 2022 Compared to the No Action Alternative

1	2	3	4	5	6	7	8
	Cumulative Net Change in NO_x from December 31, 2011 (tpy)	**Cumulative Net Change in VOC from December 31, 2011** (tpy)	**Cumulative Net Change in NO_x plus VOC from December 31, 2011** (tpy) (2+3)	**Cumulative Oil Wells Added**	**Cumulative Gas Wells Added**	**Cumulative Wells Shut In or Converted to Water Injection**	**Cumulative Net Change in Number of Oil and Gas Producing Wells from December 31, 2011** (5+6-7)
Annual Development and Production Emission Increases from December 31, 2011 through December 31, 2022 as Projected by Newfield for the MBPA (from Attachment C and Table 6-1)	745	4,833	5,578	2,496 [a]	48 [a]	950	1,594
Development and Production Emission Increases under the No Action Alternative (from Table 6-1 and discussion in Section 4.3) [b]	1,817	2,117	3,934	579	209	Not specified, but wells will be converted or shut in such that there results in a total of 788 oil and gas producing wells.	788 producing oil and gas well increase

[a] The Proposed Action includes development of up to 2,500 deep gas wells. However, through December 31, 2022, Newfield projects that only 48 of those wells will be developed. The Proposed Action also includes up to 1,800 wells served by GOSPs, but through December 31, 2022, Newfield projects only 150 wells going to a GOSP.
[b] The No Action analysis date is December 31, 2012, but as shown in Table 6-1, is essentially no difference in emissions as of December 31, 2011 compared to December 31, 2012.

The emissions from the Proposed Action are much less than would occur without implementation of the Applicant Committed Environmental Protection Measures (ACEPMs). The ACEPMs are applied annually and to the Ultimate Proposed Action. The benefit of the key measures in reducing NO_x and VOC emissions are shown in Table 6-3. The list focuses only on

NO_x and VOC ACEPMs, although there are other ACEPMs that also reduce other pollutants as well as reduce other potential environmental impacts. Some of the ACEPMs may be required by USEPA regulations; however, the ACEPMs will be implemented even if no regulatory requirement exists.

Table 6-3
Benefit of ACEPMs for NO_x and VOC Emissions for the Ultimate Proposed Action
(tons per year)

Key NOx and VOC ACEPM	NOx without ACEPM	NOx with ACEPM	ACEPM NOx Benefit	Percent NOx Reduction	VOC without ACEPM	VOC with ACEPM	ACEPM VOC Benefit	Percent VOC Reduction
Pumpjack Engines	2,836	1,465	-1,371	48%	827	397	-430	52%
Tank Controls (GOSP, centralization, and/or flares)	0	1.7 (from flares)	+1.7	N/A	8,304	3,488	-4,816	58%
Tier 4 Drill Rig Engines	1,132	613	-519	46%	236	33	-203	86%
Dehydrator Still Vent Emission Control	0	20 (from flares)	+20	N/A	946	47	-899	95%
Convert Wells to Waterflood Injection	1,256	0	-1,256	100%	1,868	0	-1,868	100%
Total	**5,224**	**2,100**	**-3,124**	**60%**	**12,181**	**3,965**	**-8,216**	**67%**

The benefits of the ACEPMs were calculated as follows:

- Pumpjack Engines: The benefit is calculated based on 3,250 new engines (i.e., 100 percent of the 3,250 new oil wells at full development of the Proposed Action) compared to 31 percent new engines (1,007 new engines and 2,243 old engines). The 31 percent value is based on the estimated current (as of December 31, 2012) percentage of new engines in the field.
- Tank Emissions: Emissions from full build out with ACEPMs includes (12 gas and oil separation facilities (GOSPs) receiving produced fluids from 150 oil wells each (1800 total) and an additional 724 oil wells that share 2 oil storage tanks between two wells that are controlled with a vapor combustor with 95% control efficiency. The storage tank vapors at the GOSPs are used in the process or sold as product and are not considered to be emissions. If GOSPs are not feasible, then the 1,800 tanks that would have gone to a GOSP will be controlled by other means (VRU or smokeless combustors). The

remaining storage tanks that do not go to a GOSP or are not served by a common battery with controls are assumed to be uncontrolled.

- Drill Rig Engines: The benefit is calculated based on drilling 156 gas wells and 204 oil wells (360 total wells per year) with Tier 4 drill rigs versus with Tier 2 drill rigs.
- Dehydrator Still Vent Emissions: The benefit is calculated based on controlling all well-site dehydrators with flares with 95% control efficiency versus not controlling the well-site dehydrators. The dehydrators include 2,500 well-site dehydrators at the gas wells. There are an additional 24 dehydrators at the compressor stations and 1 dehydrator at the gas processing plant, but it is assumed that these 25 dehydrators would have to be controlled under current regulations, thus the emission reduction from those controls are not considered an ACEPM benefit.
- Well Conversions: The benefit is calculated as if 950 oil wells had not been converted to water injection wells. The emissions include all production emissions including storage tank emissions, heaters, pumpjack engines, pneumatics, fugitives, tanker truck loading, and operation vehicle tailpipe. It was assumed that the 950 converted wells were low producers at 2 barrels/day average prior to conversion. For the 950 wells, prior to conversion it was assumed that there were two storage tanks per well and the tanks were not controlled.

6.2 Adaptive Management Strategy for Potential Ozone Impacts

Ozone concentrations in the Uinta Basin have been found to be exceeding National Ambient Air Quality Standards (NAAQS) during periodic winter inversion events. A comprehensive understanding of the chemical pathways, analytical methodologies, and demonstrable control technologies and methods has been lacking to allow for a scientifically based examination of this issue in recent NEPA documents relating to oil and gas production in the Uinta Basin. To address the uncertainty relating to this, BLM has been including adaptive management requirements in both recent and current NEPA documents relating to significant oil and gas development in the Basin. One of the components of these adaptive management prescriptions is the commitment to apply enhanced mitigation for ozone when an exceedance of the ozone NAAQS has been measured and recognized based on criteria in the Clean Air Act that defines how NAAQS determinations are made (40 CFR Part 50). Based on recent studies (citation pending, 2013), BLM believes this adaptive management requirement for enhanced mitigation has been triggered, and that tentative control determinations can be made at this time as an initial start in controlling and preventing winter ozone formation.

Over the past 3 years significant research had been conducted in the Uinta Basin to further the understanding of winter ozone formation (Martin et. al. 2011). These studies to date are indicating that volatile organic compound (VOC) controls and seasonal response plans are the most promising avenues to address winter ozone formation. BLM, in consultation with the Utah Division of Air Quality (UDAQ) and the U.S Environmental Protection Agency (EPA), has developed a list of enhanced seasonal pollution control measures and work practices specifically aimed at reducing the emissions of VOCs which form winter ozone. These control measures and work practices will be required for all operations approved under this NEPA action, and will be retroactively applied to other recent oil and gas NEPA in the Uinta Basin that have adaptive management requirements.

It is recognized in this adaptive management prescription that additional research and analysis needs to be conducted in the Uinta Basin to more fully understand the mechanics of winter ozone formation, and that specific control and work practice recommendations may change over time. To address the continued scientific uncertainty on this issue, BLM will continue to include an adaptive management requirement in oil and gas NEPA for the Uinta Basin. Once a basin-wide control plan is developed and approved by UDAQ and/or EPA, BLM will review these enhanced mitigation requirements and may add, delete, or otherwise modify these requirement to conform to the requirements or recommendations of a regulatory basin-wide management plan. These adaptive management modifications will be applicable to this NEPA action and all other NEPA actions already approved or to be approved by BLM in the Uinta Basin.

In order to assess and mitigate (if necessary) the potential for adverse ozone formation in the Uinta Basin, an Adaptive Management Strategy will be implemented under all of the action alternatives (i.e., the Proposed Action, Alternative C, and Alternative D). The Adaptive Management Strategy includes the following major elements:

- Newfield will conduct an annual emissions inventory and compare the inventory to the emissions estimates contained in this EIS. The inventory will be conducted annually for the life of the project (LOP) until the EPA/UDEQ/BLM develop an approved basin-wide control plan covering oil and gas development in the Uinta Basin.

- Regional photochemical modeling will be conducted that includes emissions for the selected alternative within one year of the ROD for this project or one year of the BLM Air Resources Management Strategy (ARMS) modeling platform becoming available; whichever occurs first. If modeled impacts show that the National Ambient Air Quality

Standards (NAAQS) or applicable thresholds for air quality related values may be exceeded, BLM will require additional mitigation measures within BLM's authority to prevent exceedances (for example requiring Newfield to implement an ozone mitigation contingency plan as described below).

The enhanced mitigation requirements to address winter ozone are as follows:

<u>Enhanced Inspection and Maintenance Program</u>

- FLIR/AVO inspections
  - Pneumatic devices / pumps
  - Tanks
  - Fugitives
- Frequency
  - Production sites with tank controls / compressor stations / gas plants
    - Annual FLIR inspection, with at least one inspection during Jan-Mar at highest priority sites based upon PTE (potential to emit) limits considered significant to ozone formation (determined by operator)
    - AVO inspection by operators during any site visits Jan-Mar.
  - Production sites with no tank controls
    - Annual AVO inspections
    - AVO inspection by operators during any site visits Jan-Mar.
- Perform regular maintenance on pneumatic devices, dehydrators, combustors, engines and compressors
- Properly operate and maintain existing installed control equipment

<u>Ozone Training for Operations Personnel</u> – Operations personnel receive training prior to ozone season. Training programs should cover the following:

- Ozone – what it is and how to it impact air quality
- Ozone formation ingredients – NOx, VOCs, and weather conditions
- Ozone attainment status in the Uinta Basin
- Review of applicable regulations
- What can be done to prevent and/or reduce emissions of ozone precursor gases – limit driving, maintain equipment, delay optional activities until after inversion, etc. Emphasize importance of proper maintenance of tank hatches, vapor combustors, and other equipment that reduces emissions.

Work Practices

- Dehydrators
  - o Perform charging of desiccant dehydration units prior to the winter ozone season
  - o Reduce glycol dehydration circulation rates throughout entire winter ozone season
- Venting Blow Downs
  - o Minimize blow down actions associated with energy recovery and production during the entire winter ozone season
- Venting – compressor startup and shutdown
  - o Reduce the number of failed startups by performing regular maintenance of compressor throughout the entire winter ozone season
  - o Reduce the number of compressor startups and shutdowns by having operating and maintenance schedules, and performing regular maintenance of compressors only during planned compressor shutdowns as possible throughout the entire winter ozone season
- Episodic Controls
  - o Delay optional activities associated with energy recovery and production during periods of UDAQ ozone alert days.
  - o Take extra care to ensure proper maintenance and operation of equipment associated with energy recovery and production that may contribute to ozone formation during UDAQ ozone alert days.

Figure 6-1: Projected NO_x Emission Increases Compared to No Action Alternative

Figure 6-2: Projected VOC Emission Increases Compared to No Action Alternative

Figure 6-3: Projected NO_x Plus VOC Emission Increases Compared to No Action Alternative

7 NEAR FIELD IMPACT EVALUATION

7.1 Construction and Development Emission Impact Results

The construction and development impact modeling scenario includes construction of well pads, drilling of wells, and developing wells on well pad sites located in close proximity to operating wells. Therefore, even though the scenario is called "construction and development", there are operating wells included in the modeling assessment. The construction and development model input and output files (electronic versions) are included in Appendix F. Table 7-1 shows the maximum impact for PM_{10} and $PM_{2.5}$. For PM_{10}, the 24-hour impact value is the high, second high modeled impact across all receptors and from all five years of meteorological data. The $PM_{2.5}$ annual impact value is the highest annual concentration across all receptors for any of the five years of meteorological data modeled. The $PM_{2.5}$ 24-hour impact value is the average of the eighth-high values from each of the modeled meteorological years. As discussed in Section 5, only one modeling scenario, the Proposed Action (Alternative A) was modeled for construction and development as the other Alternatives will have the same near field impact.

Table 7-1
Maximum Potential Construction and Development Impacts

Pollutant	Averaging Period	Ambient Air Concentration (μg/m³)					
		Year of Maximum Impact	Location of Maximum Impact	Modeled Impact	Background	Total	NAAQS
PM_{10}	24-hour	2007	100 m west of pad construction	72.5	18.7	91.2	150
$PM_{2.5}$	24-hour	NA	200 m SE of pad construction	14.3	17.8	32.1	35
	Annual	2005	100 m east of producing wells	1.4	8.0	9.4	12

7.2 Operations Impact Results

The operations impact modeling scenario includes operations of oil and gas wells and infrastructure sources (e.g., compressor stations, gas processing plants, etc.) located in close proximity. The maximum impact of criteria pollutants for the Operations modeling scenarios occurred under the Alternative A modeling scenarios. All of the results in Table 7-2 are from the oil well modeling scenario as that scenario had greater impacts than the gas well modeling scenario except for 1-hour CO which is from the gas well modeling scenario. The maximum impacts and location of those impacts are shown in Table 7-2. To determine whether impacts could be greater for Alternative C than for Alternative A due to the turbine generator emissions at the proposed substations, Alternative C was also modeled for the Operations scenario. The maximum impacts occurred when there were no turbine generators, or Alternative A. The impact of the turbine generators of Alternative C is less than the impact of other compressor engines and well operations of Alternative A. The modeling runs demonstrating this are included in Appendix F and the results shown in Table 7-3. All of the results shown in Table 7-3 are from the oil well scenario.

For CO, the 1-hour and 8-hour impact value is the high second high modeled impact across all receptors and from all five years of meteorological data. The NO_2 annual impact value is the highest annual concentration across all receptors for any of the five years of meteorological data modeled. The NO_2 1-hour impact value is the average of the eighth-high values from each of the modeled meteorological years. The 1-hour SO_2 impact value is the average of the fourth-high values from each of the modeled meteorological years. The 3-hour SO_2 value is the high second high modeled impact across all receptors and from all five years of meteorological data.

Table 7-2
Maximum Potential Operations Impacts – Alternative A

Pollutant	Averaging Period	Ambient Air Concentration ($\mu g/m^3$)					
		Year of Maximum Impact	Location of Maximum Impact	Modeled Impact	Background	Total	NAAQS
CO	1-hour	2007	140 m NE of compressor station	276	2,641	2,917	40,000
	8-hour	2009	100 m east of GOSP	137	1,657	1,794	10,000
NO_2	24-hour	NA	100 m east of producing wells	106.9 [a]	57.7	164.6	188
	Annual	2005	100 m east of producing wells	16.5	7.3	23.8	100
SO_2	1-hour	NA	100 m east of GOSP	0.7	20.1	20.8	196
	3-hour	2006	100 m south of GOSP	0.6	14.3	14.9	1,300

[a] Assumes NO to NO_2 conversion of 80%

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Table 7-3
Maximum Potential Operations Impacts – Alternative C

Pollutant	Averaging Period	Ambient Air Concentration (µg/m³)					
		Year of Maximum Impact	Location of Maximum Impact	Modeled Impact	Background	Total	NAAQS
CO	1-hour	2007	100 m south of GOSP	139	2,641	2,780	40,000
	8-hour	2009	100 m east of GOSP	80	1,657	1,737	10,000
NO_2	1-hour	NA	100 m south of GOSP	89.5 [a]	57.7	147.2	188
	Annual	2008	100 m south of GOSP	6.8	7.3	14.1	100
SO_2	1-hour	NA	100 m south of GOSP	0.6	20.1	20.7	196
	3-hour	2006	100 m south of GOSP	0.5	14.3	14.8	1,300

[a] Assumes NO to NO_2 conversion of 80%

7.3 Operations Hazardous Air Pollutant Impacts

The maximum impact of HAPs for the Operations modeling scenarios occurred under the Alternative A modeling scenario. Modeled results were compared to the Utah toxic screening levels, and the acute, chronic, and carcinogenic thresholds listed in Section 3.0 for each HAP of interest. Short-term impacts from HAP exposure were assessed by comparing one-hour average impacts to the HAP-specific acute REL (reference exposure level) and annual average impacts to the HAP-specific RfC (reference concentration for continuous inhalation exposure). If impacts are less than the REL and RfC, no short or long long-term non-carcinogenic adverse health effects are expected.

To assess potential carcinogenic impacts, the modeled annual average concentration is multiplied by a HAP specific unit risk factor to estimate the probability of contracting cancer if a person was exposed continuously to the modeled concentration. The unit risk factor is an upper-bound estimate of the probability of one additional person contracting cancer based on continuous exposure to 1-ug/m^3 of the substance over a 70-year lifetime. The risk from long-term exposure to carcinogenic HAP emissions is assessed by comparison to the generally acceptable risk range of one additional cancer per one million exposed persons (1×10^{-6}) to one additional cancer per ten thousand exposed persons (1×10^{-4}) or 100 in a million (USEPA 1993).

Since the URFs are based on 70-year exposure, adjustment factors are needed to adjust for maximum exposure durations associated with the project being evaluated. Cancer risk was estimated for two exposure scenarios: the most likely exposure (MLE) that individuals will experience, and the maximally exposed individual (MEI) as described in Section 3.4.

Table 7-4 presents the modeled non-carcinogenic impact results compared to the State of Utah TSLs for averaging periods of 1-hour (short-term). None of the HAPs exceed Utah TSLs. Table 7-5 presents the results compared to RELs and RfCs and none of the impacts exceed the RELs or RfCs.

Table 7-4
Maximum Utah Toxic Screening Level (TSL) Impacts

Pollutant and Averaging Time	Modeled Maximum Impact ($\mu g/m^3$)	Maximum Impact Year	Toxic Screening Levels [b] ($\mu g/m^3$)
Acrolein (1-hour)	1.50	2006	23
Benzene [a] (24-hour)	5.55	2005	18
Formaldehyde (1-hour)	12.32	2007	37

[a] The TSL for benzene is a 24-hour average, but the 1-hour concentration is conservatively compared to the TSL.

Table 7-5
Maximum Non-Carcinogenic REL and RfC Impacts

HAP	Modeled Maximum 1-Hour Impact ($\mu g/m^3$)	Maximum Impact Year	REL ($\mu g/m^3$)	Modeled Maximum Annual Impact ($\mu g/m^3$)	Maximum Impact Year	RfC ($\mu g/m^3$)
Acrolein	1.50	2006	2.50	0.18	2006	0.35
Benzene	5.55	2005	1,300	0.30	2005	30
Formaldehyde	12.32	2007	55	1.27	2006	9.8

Table 7-6 presents the unit risk factor, exposure adjustment factor, and the estimated cancer risk for the MLE and MEI exposure scenarios for the Proposed Action. A range of unit risk factors is available for benzene, and that range is shown in the table. All estimated risks are within the acceptable range of 1 to 100 in a million.

Table 7-6
Maximum Potential Carcinogenic HAP Risk

Exposure Scenario	HAP	Unit Risk Factor ($1/\mu g/m^3$)	Exposure Adjustment Factor	Modeled Annual Impact ($\mu g/m^3$)	Cancer Risk
MLE	Benzene	2.2×10^{-06} to 7.8×10^{-06}	0.095	0.30	6.2×10^{-08} to 2.2×10^{-07}
	Formaldehyde	1.3×10^{-05}	0.095	1.27	1.6×10^{-06}
	TOTAL MLE RISK				**1.8×10^{-06}**
MEI	Benzene	2.2×10^{-06} to 7.8×10^{-06}	0.571	0.30	3.8×10^{-07} to 1.3×10^{-06}
	Formaldehyde	1.3×10^{-05}	0.571	1.27	9.4×10^{-06}
	TOTAL MEI RISK				**1.1×10^{-05}**

There is uncertainty associated with adding cancer risk values from different chemicals together, although it is commonly done for carcinogens having similar modes of action or target organs. Both formaldehyde and benzene have been linked to possibly causing leukemia under prolonged and extremely high concentrations (CDC 2013 and NCI 2013). Therefore the cancer risk from benzene and formaldehyde were added together.

8 FAR FIELD IMPACT EVALUATION

The far field analysis is focused on evaluating air quality related values (AQRVs) at distant Class I areas, sensitive Class II areas, and sensitive lakes as discussed in Section 5. The AQRVs examined were PSD increments, regional haze, change in acid neutralization capacity (ANC), and acid deposition (sulfur and nitrogen). The CALPUFF modeling system was used to evaluate far field impacts. The model input and output files are included in Appendix F. As discussed in Section 5, only Alternative A was modeled to assess far field impacts as all the other Alternatives will have lower impacts than the modeled Alternative.

8.1 PSD Increments

Although impacts of the Proposed Action are compared to PSD increments, all comparisons with PSD increments are intended as a point of reference only and do not represent a regulatory PSD increment consumption analysis. PSD increment consumption analyses are applied to large industrial sources during the permitting process, and are the responsibility of the State of Utah with USEPA oversight. The Proposed Action is not subject to the PSD program.

Table 8-1 shows the modeled impacts at the nearest Class I areas and sensitive Class II areas compared to the Class I and II increments. All of the impacts are less than the Class I increments.

8.2 Regional Haze

To assess potential regional haze impacts, the modeled change in light extinction (b_{ext}) was compared to the 5 percent (0.5 deciviews or 0.5 dV) and 10 percent (1.0 dV) change in light extinction thresholds. The number of days exceeding the thresholds were calculated as well as the eighth-high (98^{th} percentile) change in b_{ext}. The results for the nearest Class I and II areas are shown in Table 8-2.

Table 8-1
Maximum Impacts at Class I and Sensitive Class II Areas Compared to PSD Increments

Class I and Sensitive Class II Areas	NO_2 Annual (ug/m^3)	PM_{10} Annual (ug/m^3)	PM_{10} 24-hr (ug/m^3)	$PM_{2.5}$ Annual (ug/m^3)	$PM_{2.5}$ 24-hr (ug/m^3)	SO_2 3-hr (ug/m^3)	SO_2 24-hr (ug/m^3)	SO_2 Annual (ug/m^3)
PSD Class I Increments	**2.5**	**4**	**8**	**2**	**1**	**25**	**5**	**2**
National Park Service (NPS) Class I Areas								
Arches National Park	0.0016	0.022	0.513	0.0047	0.110	0.005	0.0008	0.00003
NPS Class II Areas								
Dinosaur National Monument	0.0491	0.2334	4.55	0.0496	0.966	0.1053	0.0135	0.0005
U.S. Forest Service Class II Areas								
Flaming Gorge National Recreation Area	0.0029	0.067	0.549	0.0142	0.117	0.011	0.0014	0.00011
High Uintas Wilderness Area	0.0058	0.0913	0.779	0.0194	0.1655	0.021	0.0028	0.00016
U.S. Fish and Wildlife Service Class II Areas								
Browns Park National Wildlife Refuge	0.0046	0.0614	0.583	0.0130	0.1236	0.0130	0.0017	0.00011
PSD Class II Increments	**25**	**17**	**30**	**9**	**4**	**512**	**91**	**20**

Table 8-2
Regional Haze Impacts at Class I and Sensitive Class II Areas

Class I and Sensitive Class II Areas	Number of Days > 0.5 dV Change	Number of Days >1.0 dV Change	Max Change in b_{ext} (dV)	Eighth-High Change in b_{ext} (dV)
National Park Service (NPS) Class I Areas				
Arches National Park	17	1	2.01	0.75
NPS Class II Areas				
Dinosaur National Monument	131	89	8.12	3.20
U.S. Forest Service Class II Areas				
Flaming Gorge National Recreation Area	64	27	2.22	1.60
High Uintas Wilderness Area	85	52	3.32	2.22
U.S. Fish and Wildlife Service Class II Areas				
Browns Park National Wildlife Refuge	63	16	1.73	1.11

All the nearest areas analyzed have multiple days with a change in b_{ext} greater than 0.5 dV, and a single day with a maximum change greater than 1.0 dV at Arches National Park (although the

98th percentile or 8th-high change is less than 1.0 dV). The Federal Land Managers have not promulgated thresholds of concern for sensitive Class II areas.

8.3 Acid Deposition Impacts

To assess potential acid deposition impacts at Class I and sensitive Class II areas, sulfur and nitrogen deposition was compared to the 3 kilogram per hectare per year (kg/ha-yr) threshold for nitrogen and 5 kg/ha-yr for sulfur deposition and to the Deposition Analysis Threshold (DAT) of 0.005 kg/ha-yr for both nitrogen and sulfur species promulgated by the Federal Land Managers (FLAG 2010) for western areas. The DATs do not represent an adverse impact threshold, but rather an estimate of the naturally occurring deposition that occurred prior to any anthropogenic influences. The DATs are levels below which estimated impacts from a proposed new or modified source are considered negligible. In cases where a source's impact equals or exceeds the DAT, the NPS/FWS will make a project specific assessment of whether the projected increase in deposition would likely result in an "adverse impact" on resources considering existing AQRV conditions, the magnitude of the expected increase, and other factors. The results are shown in Table 8-3. All of the deposition rates are much less than the 3 and 5 kg/ha-year thresholds. The DAT was exceeded at the closest Class I and Class II areas for nitrogen deposition, but not sulfur deposition.

Table 8-3
Acid Deposition Impacts at Class I and Sensitive Class II Areas

Class I and Sensitive Class II Areas	Nitrogen Deposition (kg/ha-yr)	Sulfur Deposition (kg/ha-yr)
National Park Service (NPS) Class I Areas		
Arches National Park	0.0028	0.00002
NPS Class II Areas		
Dinosaur National Monument	0.0279	0.00020
U.S. Forest Service Class II Areas		
Flaming Gorge National Recreation Area	0.0147	0.00008
High Uintas Wilderness Area	0.0150	0.00007
U.S. Fish and Wildlife Service Class II Areas		
Browns Park National Wildlife Refuge	0.0092	0.00006

8.4 Sensitive Lake Impacts

To assess potential impact on sensitive lakes, the change in ANC was calculated from the CALPUFF output for sulfur and nitrogen deposition to estimate potential hydrogen ion deposition). The results are shown in Table 8-4. For lakes with background ANC greater than 25 micro equivalents per liter (µeq/l), all of the ANC changes are less than the 10 percent threshold of concern. For lakes with background ANC less than 25 µeq/l, the changes (H_{dep} in terms of ueq/l) are all much less than the 1 µeq/l change threshold.

Table 8-4
Acid Deposition Impacts at Sensitive Lakes

	Back-ground ANC (µeq/l)	**Water -shed Area** (ha)	**Annual Ave Precip** (m)	**ANC(o)** (eq)	**H_{dep}** eq	**Percent ANC Change Hdep/ANC(o)** (%)	**H_{dep}** (µeq/l)
Eagles Nest Wilderness							
Booth Lake	86.4	54.0	0.29	9190.2	9.98	0.11	0.06
Upper Willow Lake	133.2	124.0	0.29	32549.4	20.46	0.06	0.06
Flat Tops Wilderness							
Ned Wilson Lake	39.4	49.2	0.26	3312.0	1.51	0.05	0.01
Trappers Lake [a]	659.4	--	0.26	--	--	--	
Upper Ned Wilson Lake	12.9	3.1	0.26	68.7	0.92	1.35	0.11
Maroon Bells-Snowmass Wilderness							
Avalanche Lake	171.0	358.0	0.24	96575.6	55.93	0.06	0.07
Capitol Lake	186.6	139.0	0.24	40918.0	22.16	0.05	0.07
Moon Lake (Upper)	54.3	117.0	0.24	10018.8	18.52	0.18	0.07
Mount Zirkel Wilderness							
Lake Elbert	53.8	101.0	0.42	15476.4	22.21	0.14	0.05
Summit Lake	48.0	7.8	0.42	1061.9	1.65	0.16	0.05
Weminuche Wilderness							
Big Eldorado Lake	20.4	115.0	0.47	7430.2	5.78	0.08	0.01
Little Eldorado Lake	-3.3	48.7	0.47	-509.3	2.46	-0.48	0.01
Lower Sunlight Lake	85.0	96.6	0.47	26030.9	4.38	0.02	0.01
Upper Grizzly Lake	29.9	30.0	0.47	2840.5	1.96	0.07	0.01
Upper Sunlight Lake	28.0	76.9	0.47	6823.0	3.45	0.05	0.01
White Dome Lake	2.1	38.8	0.47	253.3	1.95	0.77	0.01
West Elk Wilderness							
South Golden Lake	112.6	73.0	0.29	15946.8	7.40	0.05	0.03
High Uintas Wilderness							
Dean Lake	51.4	117.0	0.41	16569.3	72.49	0.44	0.15
Fish Lake [a]	104.5	--	0.41	--	--	--	
Raggeds Wilderness							
Deep Creek Lake	40.0	525.0	0.28	39811.9	70.54	0.18	0.05
Island Lake [b]	--	--	0.28	--	--	--	--

[a] For Trappers and Fish Lakes, ANC calculations could not be made because the watershed area was not available from the USFS.
[b] For Island Lake, ANC calculations could not be made because there was no data in the USFS database.

REFERENCES

Agency for Toxic Substances and Disease Registry (ATSDR). 2013. ToxGuide for Acrolein. Available at http://www.atsdr.cdc.gov/toxguides/toxguide-124.pdf

American Conference of Governmental Industrial Hygienists (ACGIH), 2012. TLVs® and BEIs® Based on the Documentation of the Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices.

California Office of Environmental Health Hazard Assessment (OEHHA). 2013. OEHHA Toxicity Criteria Database. Available at http://oehha.ca.gov/tcdb/index.asp.

U.S. Bureau of Land Management (BLM). 2012. Greater Natural Buttes Final Environmental Impact Statement dated March 2012. Available at http://www.blm.gov/ut/st/en/fo/vernal/planning/nepa_/greater_natural_buttes.html, accessed January 2013.

Newfield, 2012. Personal communication from Mr. Rob Eales, November 1, 2012.

U.S. Environmental Protection Agency (USEPA). 1986. Guidelines for Carcinogen Risk Assessment. 51 FR 33992-34003.

U.S. Environmental Protection Agency (USEPA). 1993. Superfund National Oil and Hazardous Substances Pollution Contingency Plan (see 40 CFR § 300.430 (e) (2) (i) (A) (2))

U.S. Environmental Protection Agency (USEPA). 1997. Exposure Factors Handbook Update. EPA/600/P-95/002Fa. Office of Research and Development, U.S. Environmental Protection Agency, Washington, D.C. 1997.

U.S. Environmental Protection Agency (USEPA). 2008. Integrated Risk Information System (IRIS) Database. Available at http://www.epa.gov/iris/subst/index.html

U.S. Environmental Protection Agency (USEPA). 2009. Acrolein Hazard Summary-Created in April 1992; Revised in September 2009. Available at http://www.epa.gov/ttnatw01/hlthef/acrolein.html, accessed January 2013.

U.S. Environmental Protection Agency (USEPA). 2011a. Table 2. Acute Dose-Response Values for Screening Risk Assessments (12/19/2011). Available at http://www.epa.gov/ttn/atw/toxsource/summary.html.

U.S. Environmental Protection Agency (USEPA). 2011b. Additional Clarification Regarding Applicability of Appendix W Modeling Guidance for the 1-hour NO_2 NAAQS. Available at http://www.epa.gov/ttn/scram/guidance_clarificationmemos.htm.

U.S. Environmental Protection Agency (USEPA). 2012. Table 1. Prioritized Chronic Dose-Response Values (5/21/2012). Available at http://www.epa.gov/ttn/atw/toxsource/summary.html, accessed January 2013.

U.S. Environmental Protection Agency (USEPA). 2013a. Air Quality Statistics. Available at http://www.epa.gov/airquality/airdata.

U.S. Environmental Protection Agency (USEPA). 2013b. NO_2/NO_x In-Stack Ratio Database (ISR). Available at http://www.epa.gov/scram001/no2_isr_database.htm.

U.S. Forest Service (USFS). 2000. Screening Methodology for Calculating ANC Change to High Elevation Lakes. December 2000. Available at http://www.fs.fed.us/air/documents/anc_scre.pdf.

U.S. Forest Service, National Park Service, and U.S. Fish and Wildlife Service. Federal Land Managers' Air Quality Related Values Work Group Phase I Report -- Revised 2010. (FLAG). 2010. Available at http://www.nature.nps.gov/air/Permits/flag/.

U.S. Geological Survey. (USGS). 2013. USGS Shuttle Radar Topography Mission Data. Available at http://eros.usgs.gov/#/Find_Data/Products_and_Data_Available/Elevation_Products.

U.S. Department of Labor, Occupational Health and Safety Administration (OSHA). 2013. Chemical Sampling Information for Acrolein. Available on line at http://www.osha.gov/dts/chemicalsampling/data/CH_217100.html.

Utah Division of Environmental Quality - Division of Air Quality (UDAQ). 2011. Utah Division of Air Quality Impact Assessment Guidelines. 2011. http://www.airquality.utah.gov//Permits/DOCS/June2011/EmissionsImpactAssessmentGuideline.pdf

Utah Division of Environmental Quality - Division of Air Quality (UDAQ). 2012. Impact Assessment Guidelines and 2012 ACGIH—TLVs and UDAQ—TSLs and ETVs, 2012. Available on line at http://www.airquality.utah.gov/Planning/Modeling/NSR_Permit_Modeling/Modguint.htm, accessed January 2013.

APPENDIX A

ALTERNATIVE A -- PROPOSED ACTION ULTIMATE DEVELOPMENT EMISSIONS

APPENDIX A-1

PROPOSED ACTION OIL WELL EMISSIONS

APPENDIX A-2

PROPOSED ACTION GAS WELL EMISSIONS

APPENDIX B

PROPOSED ACTION ANNUAL DEVELOPMENT EMISSIONS

APPENDIX B-1

MONUMENT BUTTE PROJECT AREA EMISSIONS AS OF DECEMBER 31, 2011

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APPENDIX B-2

PROPOSED ACTION DEVELOPMENT FOR 2012

APPENDIX B-3

PROPOSED ACTION DEVELOPMENT FOR 2013

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APPENDIX B-4

PROPOSED ACTION DEVELOPMENT FOR 2014

APPENDIX B-5

PROPOSED ACTION DEVELOPMENT FOR 2015

APPENDIX B-6

PROPOSED ACTION DEVELOPMENT FOR 2016

APPENDIX B-7

PROPOSED ACTION DEVELOPMENT FOR 2017

APPENDIX B-8

PROPOSED ACTION DEVELOPMENT FOR 2018

APPENDIX B-9

PROPOSED ACTION DEVELOPMENT FOR 2019

APPENDIX B-10

PROPOSED ACTION DEVELOPMENT FOR 2020

KLEINFELDER

APPENDIX B-11

PROPOSED ACTION DEVELOPMENT FOR 2021

APPENDIX B-12

PROPOSED ACTION DEVELOPMENT FOR 2022

APPENDIX C

ALTERNATIVE B -- NO ACTION EMISSIONS

APPENDIX D

ALTERNATIVE C – FIELD WIDE ELECTRIFICATION EMISSIONS

APPENDIX D-1

FIELD WIDE ELECTRIFICATION ALTERNATIVE OIL WELL EMISSIONS

APPENDIX D-2

FIELD WIDE ELECTRIFICATION ALTERNATIVE GAS WELL EMISSIONS

APPENDIX E

ALTERNATIVE D – RESOURCE PROTECTION ALTERNATIVE EMISSIONS

APPENDIX E-1

RESOURCE PROTECTION ALTERNATIVE OIL WELL EMISSIONS

KLEINFELDER

APPENDIX E-2

RESOURCE PROTECTION ALTERNATIVE GAS WELL EMISSIONS

APPENDIX F

ELECTRONIC MODELING FILES